The Builder.

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The "Revue Générale de l'Architecture."

THE last six numbers of the journal conducted by our esteemed *confrère*, M. Cæsar Daly, sustain its reputation in regard to sound criticism and literary merit in the text, as well as first-rate execution in the illustrative engravings. Among the subjects included in these numbers are reports of the proceedings at some of the *Conférences Nationales de la Société Centrale des Architectes*, in which matters are touched upon of general interest to the profession in all countries. The third and fourth meetings of the *Société* (on the 12th and 13th of June last) were occupied by a lecture from M. Daly himself, on the subject of "the intimate alliance and influence of the double study of archæology and architecture on the history of civilisation;" and we have a pretty full report of a meeting just previously to this, at which the subject of public competitions was discussed, which so largely occupied our own central society not long since: one or two of the ideas on the subject we may note. M. Coisel, among other points, objected entirely to "international" competitions as nonsense, on the ground that each people had its own architecture suited to its own climate. Most of us will agree with the editor of the *Revue* that this is stretching a principle rather too far. The following general principles are quoted as meeting with the concurrence of the assembly:—

That competitions were not always desirable, but when held they should be open to all comers.

That foreign architects should be admitted to them, with some exceptions, "*que peut dicter, aujourd'hui le patriotisme.*" (That is to say, of course, that no German architect may compete. We can only lament that "*le patriotisme*" should thus be allowed to override common sense, although we may we may not feel much surprise that it should under the circumstances.)

The architect who has the first premium should always be employed to carry out the work.

The competition should be decided on sketches accompanied by a detail to a large scale. (This is not a bad idea, and has been suggested in England.)

The jury should be composed partly of members named by the administration, and partly of persons elected by the competitors. This latter clause seems to have been contested, one member asking, "whether criminals named their own judges?" but the sense of the meeting was with the proposal.

It is comforting to find that, in spite of these admirable notions of what is right, the competing architect in France has his grievances; for in an article in the same number, criticising the competition for the rebuilding of the Hôtel de Ville, it appears the competitors were directed to provide considerably more space in every department than existed in the old building, while at the same time they were strictly enjoined to utilise as much as possible of the remains of the former structure. Here was the point then;—to build on the old walls, which were perfectly good as foundations, and at the same time to provide the extra space;—about as ingenious a "competition" dilemma as we have heard of. Sixty-six architects endeavoured to solve it.

In No. 7-8 we find a long and useful practical account of the construction of the "Depôt des Forges et Fonderies du Val d'Osne," in the Boulevard Voltaire, and a geological and chemical analysis, by M. Detain, of the building stone obtained from the Kersanton rock (near Brest harbour), a stone which has been much used for three or four centuries back in the building of churches in its neighbourhood, and has, we are informed, shown weather-resisting qualities almost superior to those of granite. M. Pascal furnishes his impressions of architecture at the Vienna Exhibition, in an article more occupied, in fact, with the architecture of Vienna itself, of which he seems to have imbibed a righteous horror. M. Pascal preaches against cement in a strain that Pugin need not have been ashamed of, and observes that a town which had variety enough of building material to furnish every suggestion for a special originality of treatment had thrown it all away for an expression of grandiose vulgarity. "Age will tarnish these structures" (the dwelling-houses of the new town) "instead of embellishing them," a remark which embodies a great deal. The art of growing old in a dignified manner is confined to true architecture as well as to true men. The whole aspect of Viennese modern architecture is pithily summed up in the words, "*constructions mensongères, fausses, peu durables, mais puissantes d'aspect*"; and with the latter attribute the inhabitants are content. As "certain quarters of new London," we read, present the same aspect, the criticism must be taken home to ourselves also. The same writer contributes to No. 9-10 a criticism on *Les Envois de Rome en 1873*, a subject on which a very lively article was contributed in a former year by M. Garnier, to which we made reference at the time. *Les Envois de Rome*, our readers may not all be aware, are the studies annually sent to Paris by those students (*pensionnaires*) who have obtained what we should call an "exhibition," which provides them funds to go and study in Rome. Comparing this with former articles on the same topic, we are not surprised to find M. Pascal thinking a word of apology necessary for the sameness of subjects and studies turned out year after year by the successive generations of students. The restoration of the Temple of Vesta appears to be one of the prime objects of ambition, varied by similar efforts in regard to other remains of Roman architecture. "Work on your own account," says our critic; "forget that your neighbour was working at the same study yesterday; they" (the ruined temples) "may teach you something different from what they taught him." This may be; but one cannot help feeling that there is something very frigid and academical in the nature and manner of the studies here indicated.

The paper by M. Ravon, "*De la Responsabilité des Architectes*," a criticism on a paper on the subject read by M. Hermant, at one of the "conferences" above referred to, goes very fully and ably into the question of the extent to which the architect should be held responsible for failures in buildings erected from his designs. The writer sums up in the phrase, "La responsabilité est la sanction du devoir;" it is "responsibility" which raises the character of the architect, gives him the consideration which he desires, and is the safeguard of public life: a conclusion which may be carried too far, perhaps, but which errs at least on the right side, and has a healthy sound about it. The argument seems to have been complicated by the fact that the words "architect" and "contractor" (*entrepreneur*) are, in France, constantly used interchangeably and as if synonymous, a difficulty we have not to contend with here. In the most recent number before us, M. Planat (engineer) commences a series of articles on railways, the first being occupied mainly in an inquiry into the rate of increase of railway traffic and railway work and expenditure in various countries and under various circumstances. The diagrams showing by means of curves the relative progress of different nations in the same periods of time, are very interesting and suggestive; and will be still more so, as the writer hints, if studied in conjunction with the political and social history of the governments referred to. He calls attention to the contrast between "la brusque courbe prussienne," turning up sharply at a greatly increased angle about 1864, and the "nonchalante ligne autrichienne," following a somewhat uneven but in the main regular direction, at a low rate of increase. In England the curve is an almost regular and unbroken one, at a high rate of increase, up to 1850, where there is a break, and a somewhat lesser inclination is assumed; at 1864 there is another more sudden bend, and the progress becomes considerably slower. The line showing the railway progress in the United States is significant enough; it shows an almost unbroken curve of parabolic character, starting at nearly the same angle as the English, but increasing rapidly after 1848, between which year and 1854 the increase is from 9,000 to 2,400 kilomètres of iron road. Progress in England, however, is more rapid than in any other country, except America. In England, says M. Planat, "in the interior of that great laborious workshop, where everything must pass in haste from hand to hand, where every one wishes to hurry, means of transport could not be slow to multiply. . . . There is no hesitation with the English, when once they are convinced that they will, in the end, reap profit and advantage from their efforts." Perhaps the compliment savours a little too much of the old "shop-keeping" theory in regard to this island and its inhabitants. From what we gather, M. Planat intends, in continuing his essay, to indicate the relation between the architectural profession and railways. So far as it has gone it is a very interesting contribution, and its author has the art of presenting facts and statistics in a lively and picturesque manner, not unenlivened by wit and humour.

In the same number, M. Daly signalises "a new way of encouraging the arts," invented by the "Société d'Encouragement pour la Propagation des Livres d'Art," who decided, in solemn conclave, met to consider the question, that the plates of all engravings distributed as premiums or prizes to their members should be destroyed, by way of enhancing the value of the engravings! We can only echo the bewilderment of our colleague (himself a member of the Society in question) at what he calls this "*logique des collectionneurs*," and hope that his efforts to set the matter in a right light have met with success.

Among the illustrations of these numbers, the most interesting, perhaps, on some accounts, is the engraving of the monument to M. Duban, designed by M. Viollet-le-Duc. The design is not, as English students of its designer's works might expect, Gothic; it assumes the sarcophagus form, terminated at the head by an upright memorial stone, with surbase and cornice, and "nook shafts," in the shape of fluted columns, with "Temple of Vesta" capi-

tals; the finial above is decorated with the Greek honeysuckle and acanthus in relief on the face. Below (between the shafts) is the bas-relief profile of Duban in a medallion, with the legend, "*A Felix Duban ses Amis, ses Admirateurs,*" and (in a modest corner below the surbase) "*ses Élèves.*" A festoon hangs obliquely across the face, caught on an angle of the surbase; a palm-leaf, lightly sculptured, appears to lie on the sarcophagus. The design is one which, as the reader will gather, would not find much favour amongst English architects of the present day, and goes against more than one accepted canon of architectural design among our "modern school." Without echoing the criticisms of the said school, we may confess to a little disappointment in this monument of one eminent French architect to the memory of another. "Honorer de tels hommes, c'est honorer soi-même," said M. Baltard appropriately in his short address at the inauguration of the monument: we might perhaps have wished the designer of it had honoured himself a little more decisively in this case; but, of course, we must judge of such a thing in the light of French architectural taste and association, which in these matters is different from English. Of the buildings illustrated, we cannot say that the design is always equal to, or worthy of, the beautiful engraving expended on them. Such buildings as the "Bibliothèque Nationale" and the "École d'Equitation" illustrate the weakness of the modern French artificial style, which can deal but ill with buildings of a simple practical character, where ornament would be out of place. The front of the "Depôt des Forges et Fonderies," by M. Fevre, shows some very refined and elegant detail; and the iron gates from the same building, shown in larger drawings, are admirable specimens of ornamental ironwork, treated in a "Classic" manner, but completely in character with the material. One of the finest illustrations (in No. 5-6) is a large double-page engraving of two carved table supporters found in the "house of Rufus" in Pompeii; the design consisting of griffins *dos-à-dos*, common enough in idea, but executed with a breadth and vivacity of treatment and execution rarely found in modern work.

The leading architectural periodical of France deserves, let us be permitted to say in conclusion, more attention in England than it at present receives, as a thoroughly trustworthy and well got-up publication.

A BUILDING ACT IN UTOPIA.

The truly right honourable gentleman who now presides over the art-councils of Utopia is not only fitted for the post he occupies, but he maintains that the best way of promoting the greatest happiness of the greatest number is to do his duty by the country in general, and the art-world in particular; by the department he rules; and by himself. A master of language, he dispenses with both literary slang and political invective. Naturally an artist, he harbours neither jealousy in thought, nor utters personalities in speech. Between the stools of style, fashion, or conceit, he never falls, because his chair is placed upon an eminence above them, which enables him to enjoy a wide expanse of observation and exercise a broad range of criticism. While meaner men of meaner nations are floundering and foundering in the straits betwixt a Scylla which one has plundered, and a Charybdis where another has blundered, the Utopian art-minister performs his part for the common weal silently and gracefully; and, a Ulysses of travel, uses his profound acquaintance with men and countries for the public good—never obtruding it, however, or indeed anything except the fact, which he is unable to conceal, of being a gentleman to the manner born.

So complete are the reforms lately effected that the metropolis of Utopia is now the one city in the universe where the sun shines without oppressing summer revellers; where the wintry rain falls to clean, not to soil, the streets; where mud is never formed, because the materials to make it are not permitted to collect; where the smoke of chimneys, instead of polluting the homes of the rich, helps to comfort those of the poor,—since the consequent economy of its methodical consumption has reduced the price of coal; where there is a government to rule localities, not a wrongly-constituted local board to misgovern; where vestrymen are the only occupants of the workhouses they once helped to fill; where poor-rates aid the poor, for there are many poor, though only the deformed in body or mind are paupers. Sanitary legislation, which originally consisted in providing comfortable sinecures for an army of "inspectors," now penetrates the homes of the multitude; nearly four million souls, who once dwelt in ignorant security over a volcano of sewer gas and boiler steam, now court the breath of life instead of battling with the poison of death; the most extensive system of town drainage in the world has been systematically ventilated, yet not before the disadvantages of non-ventilation were successfully proved by the death of many innocent persons; because, although ventilation was theoretically known to be a necessity, nothing used to be accepted or discarded by Utopian society until it had been practically tested. To be one of a dinner party now is an agreeable treat, since the guests no longer sit on each other's laps, nor, in the absence of other air, inhale the contents of each other's lungs; the clubs are now places for the social enjoyment of the members, not for the exclusive profit of speculative proprietors; the courts of law still disinfect the land from moral plague, but they are no longer plague-spots themselves. In the churches the worshippers can see and hear, and understand both "storied pane and animated bust;" and since people have gone there exclusively to obtain spiritual consolation they have ceased to take interest in the dissensions concerning stoles and chasubles, chalices and candles, tables and baldacchinos.

This consummation was not accomplished without an infinity of contradiction in art misunderstood and science misapplied, engendering a vast amount of bad blood, which of old was called party-spirit. Before sanitary legislation of any description was mooted, a new Building Act was introduced into Parliament, because it was felt that any attempt to drain, warm, ventilate, and generally improve human dwellings must begin at the beginning; and that the root of the then existing evils lay deeply imbedded in the prejudices and habits with which three centuries of artificial architecture and imported art had imbued men's minds. It had been the custom in framing legislative Acts concerning building to trust to the mother-wit of lawyers, doctors, eminent brewers, and railway company chairmen; and the argument in favour of such a jury consisted in the supposed fact, that very few people, professional or otherwise, knew anything at all of the subject; and that an indiscriminately collected commission would be just as likely to succeed in the matter as a technically chosen one. But the present art-minister having carefully watched the proceedings of those of his countrymen who gained a livelihood as architects and engineers, fancied he perceived through the thick covering of conventionality which, in their works, hid their real thoughts from the world, a vein of reality and a cynical contempt for the degradation they were compelled to undergo from sheer personal necessity, and the public inability of judging artistic truth from falsehood. So he called together the heads of the two professional bodies, and, it must be owned, had a sorry time of it while the commission sat. It was a babel of "mutual scorn." The architects and engineers not only despised each other's handicraft, but each member of both professions depreciated the other. Some of the engineers belied the great deeds of their earlier brethren by seeming to be ashamed of the materials with which they worked, and attempting to hide with theatrical appliances even the metal which forms the machine whence is derived their name. In the ultimate appeal to Parliament their opinions, however, prevailed, because they had principle and reason to support them; and common sense is a sure touchstone with educated communities. Some of the architects, too impenetrably obtuse to perceive the ruin impending over their heads, came to the meeting attired in the masks and dominoes of a forgotten carnival. Happily there were among them others whose education as gentlemen was superior to their acquirements as architects, and it was eventually discovered that a basis could be formed on which to erect a superstructure of principles and laws mathematically accurate and logically unimpeachable. With this to aid them, they dissected the carcass of an old-fashioned dwelling-house, and built up in theory a modern and more habitable one; but not without a formidable opposition from all classes of the population, and more especially from those who experienced most acutely the evil influence of the original Building Act. The old laws which related to the thickness of walls, the protective guarantees of party-walls, the height of chimneys, the frontage of houses and the projections upon them, were good enough in their way; but they in no wise afforded assistance to the promulgation of true art or scientific construction. The skill of practitioners, both in Utopia and in the adjoining country, used to be wasted in futile experiments for evading the clauses of their Building Acts. It was the custom in those days to give opportunities of employment to all classes of inventors. The architect, for instance, designed a fireplace, which, with the simplest calculation, required a flue of certain size. The builder constructed one for it at half the necessary dimensions. The architect then called in a grate-manufacturer, to remedy the defects of the fireplace, and the builder ordered a chimney-pot-maker to ameliorate the condition of the flue, the result being satisfactory while the wind remained in three out of four points of the compass, the other being that particular corner in which the wind is said to cause all chimneys to smoke.

It is well known that the peculiar constitutions of Utopians compel them to pass a great part of the day on the stairs and in the passages of their houses. They often breakfast in the basement story, and dine on the ground-floor; they receive visits on the first, sleep on the second, and keep their children on the third floors of their residences. Yet the stairs, even in the expensive quarters of the metropolis, were made of inferior wood (often of the most inflammable sort), about twice the width of a builder's ladder, with the disadvantage of the steps at intervals winding round a pivot, so that great nicety of balance was required on the part of any gentleman conducting a lady from one floor to another. As it was usual for one or more incendiary fires to occur every night of the year,—and as the first part to burn of a house was the staircase,—there used to be stationed at the corners of the streets a machine, consisting of a man-shoot, or ladder on wheels, called a fire-escape. But as this machine was never long enough to reach higher than the third floor of an ordinary house,—and as some of the more modern dwellings were often five and six stories high,—it was customary to devote the upper portions of such residences to the less important members of a family, such as servants, poor relations, or bachelor uncles who had made their wills, because all escape in the event of fire was acknowledged with Spartan simplicity to be impossible. Some of the great hotels were even worse situated, since a conflagration in the lower portions of those huge buildings rendered escape by the internal fireproof stairs futile, while the portable exterior fire-escape could afford no assistance above the second-floor windows. But since it was tacitly understood that only bagmen and foreigners were allowed to inhabit the upper rooms of those hotels, the authorities had not deemed it necessary to interfere; and the old laws were felt by the conservative sentiment of that time to answer the purpose for which they were intended.

The original Building Act having been framed in the palmy days of jocular legislation, it had been enacted that every habitable room should be 7 ft. high, from floor to ceiling, the joke being that no room of such a height could possibly be habitable. In the capital of an adjoining country, no room was ever allowed to be less than what, in Utopian measure, is 2 in. more than 9 ft. The culminating joke of the Act, however, was the law regarding cornices and rain-water pipes. In the barbarous Middle Ages strong projecting roofs protected the foot-passenger from the sun and the rain; and often a grotesque gargoyle cast the contents of a carefully constructed mediæval gutter into the road-way. People knew the gargoyle was there, and could avoid it if they chose; but the ratepayers, since the Reformation, and the passing of the original Building Act, were differently treated. As it was difficult to get them to pay any local taxes at all, the first object of a municipality was to make the streets as dirty as possible, in order that there might be no excuse for refusing to pay rates to clean them. It had consequently been enacted that an iron pipe should convey the rainwater from the roof of each house to the level of the foot pavement, and discharge it thereon, under the soles of pedestrians. At the same time every precaution was taken to cause a small but constant dripping of rainwater from the cornices and ornamental features of the house fronts. These cornices were so constituted as to catch the falling rain, and thus moisten the external walls; the dust and soot

settled upon them, and these were quickly converted by the rain and mist into mud, which was once thought an unavoidable accessory to civic ease and metropolitan elegance.

Philosophers say that, amongst virtuous communities, one half are usually ignorant how the other half live; and amongst vicious communities one half are always occupied in making life unpleasant to the other half. So the majority of the ruling powers in old-fashioned Utopia, being married men, succeeded in making unmarried men as unhappy, though in a different way, as themselves. The happiness of a married man, which consists in having a home, is often marred by the person with whom he is compelled to share it; and the happiness of a single man, which consists in undivided enjoyment of life, is equally often marred by having no home in which to enjoy it. Consequently it used to be enacted, that unless bachelors inhabited a building containing more than 125,000 cubic feet of space, the floors of lobbies, corridors, passages, landings, and flights of stairs, should consist of inflammable materials; and that unless sets of chambers, or "flats," covered 3,600 ft. square in area, they were not to be divided by party walls, party arches, or fireproof floors. It resulted, therefore, that the great mass of the metropolitan population of Utopia, whose incomes did not exceed 300*l.* per annum (and who paid income-tax), incurred the risk of nightly destruction by fire; while those, whose incomes did not exceed 100*l.* per annum (and who did not pay income-tax), experienced certain death in the event of an incendiary outbreak. In the business portions of the metropolis, the lower stories of the houses are often devoted, now as before, to trade purposes, and the upper stories to residences for small families and bachelors; but these last are no longer compelled to transact the whole business of life in rooms expressly constructed for sleeping purposes only. Before the present Building Act was passed, "flats" were unknown to the many and discountenanced by the few. Indeed, when merchants and tradesmen used to build houses for themselves, in the city or its neighbourhood, they paid attention to the planning of those parts they intended to use as business premises, but no more. As they proposed to let the upper floors,—and as lodgings of every description were eagerly sought after,—they used to be perfectly careless of the distribution of the upper rooms and offices since they were certain to let them, no matter what they were, at a considerable profit. As the gaspipes belonging to one story of such houses could not be repaired, or even examined, without removing the wood-flooring of another, leakage was seldom heeded, each lodger preferring to inhale the other's gas to incurring pecuniary damages. None of the staircases used to be lighted at night, because, being common to both landlord and his tenants, they belonged to no one,—the landlord carefully stipulating his rights in an agreement which as carefully ignored his duties. A housekeeper, being provided with a room to live in as wages, was expected to live on the lodgers; and often the breakfasts of half a dozen bachelors were consigned for the night to a shelf over the bed upon which she slept. Yet, within a day's journey of Utopia, there was a large city, the majority of whose inhabitants lived in "flats"; and where a quantity of both small and large families managed to subsist in comfort, economy, and security under one roof, in perfectly distinct sets of *appartements*. That which made the Utopian capital so expensively disagreeable a residence was due, in a great measure, to the perpetual disregard of the simplest sanitary laws, and the misapplication of taxes levied for the purpose of enforcing them.

The original Metropolitan Building Act of Utopia permitted ancient dilapidated buildings to be repaired with the same description of materials as those used in the original structure. Consequently an old house could be made to harbour generation after generation of vermin, noxious disease, and every element of decay, unless fire providentially destroyed it with those of its inmates and neighbours who had escaped the infection of its previous existence. Regulations respecting iron were not included in the old Act, or, at best, only dimly referred to. There used to be nothing except moral persuasion to prevent the introduction of iron girders too weak to support their own slenderness, or of wooden beams so heavy as to succumb beneath their own weight. The projecting oriel or bay window, which is intimately associated with the national manners and traditions, was, until lately, an impossibility in a metropolitan thoroughfare, through the illogic of laws which harassed more than they protected. It is now to be seen in every house-front at a certain distance from the street level, and is the most agreeable corner of a town room. The railway-tunnels beneath the carriage-ways are now ventilated by brick shafts carried up at the street corners; and these enhance the effect of the sky-line. The great and small drains (which used to emit their noxious gases in the public thoroughfares) and the private closets of the inhabitants are now ventilated by a specially-constructed flue built into the wall of each house, which serves as a vertical drain to receive the water-closet and other pipes; and it is prolonged to 6 ft. above the top of the highest chimneys. To each water-closet is attached a flue ascending above the roof, and this is prescribed by law. The size of windows and doors is determined in proportion to the dimensions of the rooms to which they belong; and the width of staircases by the number of stories they serve; while the rise and tread of steps follow a mathematical rule. Gas is not permitted to be used in any chamber unless means of exit for it in case of its escape be provided, and the discovery of leakage has been simplified by forbidding the insertion of gas-pipes into the plaster of walls and ceilings, or their concealment between the floors, on any pretext whatsoever.* The state of the roads and footways is also improved. There is no longer an open gutter on either side of the carriage-way; a sunken channel has been constructed and covered with perforated iron plates, so as to facilitate the immediate disappearance of the rain-water; while the house rainwater-pipes discharge themselves into it by means of a small drain constructed under the foot pavement. Rainwater-pipes are now always isolated 1 in. from the wall to which they are fixed, and they are never permitted to be placed inside a building, while the eaves-gutters which they drain are each provided with an overflow gargoyle in case of obstructions in the rainwater-pipe. An iron or a zinc ladder follows the slope of each roof, and iron *échelons* are fixed to each chimney and ventilating-shaft. The new Building Act is as much an assistance to architects as the old was an annoyance to builders. Under the old system, each fresh building added to the ugliness of the metropolis; under the new, each addition tends to improve it. Balconies upon which none dared venture; balustrades to protect roofs to which no one ascended; cornices to spread, not to throw off, moisture; consoles to hold up entablatures which were supported by the counter weight of the wall over them; lintels made of voussoirs, and arches of lintels; pierced gables and divided pediments in solitary prominence above houses innocent of roofs, or, at best, with low-pitched roofs of a shape totally at variance with them,—these were the chief architectural features of the old metropolis. Now that they are swept away, none care to regret them except those whose day departed with the horrors they had helped to accumulate. The national architecture at last reflects the national thought, and the intelligent treatment of architects by the State is assisted by the serious attempts of the former to reconcile their art to the demands of modern society. In the capital of Utopia, the arts and sciences are no longer divided; the engineer is an ancient architect, and the architect a modern engineer. Common sense now reigns in professional councils, and reason has mounted to its throne again.

THE CENTRAL DOME OF THE VIENNA EXHIBITION BUILDING.†

Third Principle.—Co-operation of Independent Parts.—The first principle I have enunciated as guiding our choice in forms of large structures is—unity or absence of antagonistic action in different portions of the structure, each tearing, crushing, or otherwise counteracting the effect and destroying the use of the other.

The second is the disposition of the useful load of the material of the structure in those places, forms, and quantities; in those places where the injurious effect of its inevitable weight will be the least possible.

There is a third principle allied with these two, in the cone, and perhaps it is most important of the three, that in every large structure every part of the whole should be ready and able to render assistance to every other part in the performance of its duty, or in the case of imminent danger. Each part should not merely do its own duty, without hindrance or impediment from another part; but it should be placed in circumstances which enable it to lend all the reserve of its own strength to each other part that is exposed to severe, excessive, or exceptional trial. This principle is rarely well carried out, or recognised at its full value. As I consider it one of the most important principles of the future of large architectural structures, I will illustrate it as fully as may make it clear.

Allow me to premise that the antagonistic principle of independent action of parts is a tradition of your profession and of mine. One of the most beautiful scaffoldings I ever saw was made thus for the building of a large elliptic arch. The whole of the centreing sprang from two points, to every small portion of the arch went two long beams from the two springing centres. The pair met, and they too sustained one stone, or one group. A second pair, starting still from the same centres, sustained a second group, and so on, till perhaps some fifty independent pairs carried the whole arch. This had the great advantage that the giving way of one pair did no harm to any other pair; it was the principle of perfect independence carried out in timber struts. In like manner, you may have seen iron bridges, of the nature of wire suspension bridges, where, instead of the single centreing chain, successive points of the bridge platform were carried by pairs of ties going straight to the summits of the two piers, and thus suspending their portions independently, so that weight on one should not affect the others. By this independence it was intended that the oscillations of the swing-bridge should be prevented.

But even without referring to structures in which this independence of parts was a special aim, I may observe that the traditions of your profession and mine, and the practice we have seen, introduced this independence into general use. When I learned shipbuilding we used to put what amounted to three ships one inside the other. The first consisted of outside planking, intended to keep out the water; the second consisted of a complete vertical frame, to keep the pressure of the water from forcing in this planking; the third consisted of another series of planking, to keep these two discordant elements in position under the action of the waves. These ships were each in general heavy enough to make each a ship; but when it came to a large one, all the three were too weak, and the triple ship went to the bottom.

Well, it was one of the early studies of my life to try to remedy these evils. I found the same absurd notions of independent action of parts of a ship, which had ruined wood shipbuilding, were being rapidly introduced into iron ship-building, and if I was instrumental in contriving and introducing a new principle of construction into modern naval architecture, on which our best ships are built; it was the system of making the whole of the particles of the iron in a ship do effectual work, not in one function, nor in one way only, but by making all the parts of a ship help all the other parts to do their work, as well as each part its own. It is for this reason that the *Great Eastern*, the lightest built ship in the sea, the cheapest built and the strongest, although the worst treated, has proved able to save herself and her crew and freight,—when left helpless to the storm, when torn open by being steered on the rocks, and when distorted by internal explosion; she owes her strength to the principles ennunciated as Nos. 1 and 3. All the parts of the *Great Eastern* are one, with the whole and with each other. The skin keeps out the water, but it also supplies the place of a frame, which in her is wanting. Bulkheads divide the ship into water-tight compartments; but these bulkheads carry the decks, give shape to the ship, and form part of the masts. The decks carry the goods and keep out the water; but they too are of iron, are integral parts of the hull, and give the strength against the sea required by her great length. The coal bunkers, which once were loads to a ship, are now mere spaces left between her integral portions of iron in the hold. Even the engine-frames are built up parts of the ship, and equally save the engines from being strained and the ship from straining. The very divisions of the cabins are partitions of iron welded as integral portions of the ship, and when you sit down on a velvet

* Many of the provisions of the present Building Act, it has since been discovered, have been in force during the last twenty years in the capital of a neighbouring country.

† By Mr. J. Scott Russell, F.R.S. Read at Institute of Architects. See p. 122, *ante*.

sofa, or sleep on a luxurious couch, you will find that the bottom of the sofa is welded to the ship, and forms there a part of the general support of the strain. Thus the ship is a great whole, each part helping each, and so neither the hate of her foes, nor the folly of her friends, have yet been able to destroy the *Great Eastern*. It may, perhaps, seem to some of you to be unnecessary for me to have done more than state so axiomatic a truth, as that a great structure should form of all its parts a complete united helpful whole, that its strength should not be frittered away by making it a mere assemblage of multitudinous parts, each performing some petty function apart, and contributing little or nothing to the general strength, or to the security of each other. But, in truth, the great difficulty to be overcome in the introduction of such modern structures as we are now considering, is to obtain the recognition of these principles as imperative laws of practical construction.

Mechanical Nature of the Iron Cone.—The Crushing Strain.—An iron cone may be examined and tested in two ways,—it may be exposed to pressure from within on the hollow side, or to pressure from without on the round side. I have never seen a formula which explains and predicts the result either way. My conical roof can be best understood by adopting a method of thought, which is, possibly, very different from that generally followed. Nevertheless, as men of eminence, who have looked at it in ordinary ways, have failed to comprehend it, and even been led to false conclusions, you will excuse me if I take you a short, simple, but unusual way, to the bottom of this deep well, or to the top of this high cliff.

To understand my conic roof, I ask you to fancy a ring or cylinder of wrought-iron plate homogeneously riveted together into one upright plate, 200 ft. high, and 360 yards round, and say 1 in. thick. This huge ring, say a few hundred feet high, would be like a large ugly gasometer of unusual hugeness. Let us use this idea to calculate our strength.

Every yard high of this ring, for each inch round, would weigh 10 lb.; it would, therefore, take 224 yards high to bring a weight of one ton over each inch of ring. The maximum strain possible on the lowest heaviest strained part of this ring, is one ton on the square inch,—say one-fifth, one-tenth, or one-twentieth of the safe, or yielding, or breaking strain; therefore perfectly safe, and far within the widest practical margin. But 224 yards high for one ton of strain is far beyond my wants: I only want for my use less than a third part of that least strain. I take a ring exactly 200 ft. high,—strained, therefore, to less than one-third of a ton per inch; I ask you to conceive clearly this ring resting on a smooth, flat, level base: you will see that the strain cannot, by any invention, be made greater or less than simply the weight per square inch, due to the upright column of metal standing above each inch of base and diminishing gradually upwards to the summit, ending in O. I next ask you to follow me while I cut this cylinder into pieces, but leaving all the pieces in their places; I now cut the cylinder vertically into couples of triangles, an upright triangle, and an inverted triangle, turn about; I now remove all the inverted triangles, and leave all the others standing upright in a ring, as before, points up. I have taken away half the whole iron. I next incline all these triangles inwards towards each other, and they all then touch each other along the edge from heel to point.

These triangles, say thirty in number, form my cone; they are slightly curved one way, their upright axes remaining straight when inclined, their curvature being diminished exactly in the ratio of their diminishing width. While these triangles lie in that shape, allow me to put perfect solder on all the joints, and to fuse it by electricity. My cone is complete.

Now the conclusion at which I arrive is, that in this state the matter of my cone is nowhere more or less strained than it was when it had not yet become a cone, and was the original upright cylinder; in other words, the strain on my cone is everywhere less than one-third of a ton per square inch. The proof is simple. The inclination I give the cone being eighty degrees, doubles the upright pressure; but the triangles I have cut away remove half the weight. Half the weight, therefore, with double the pressure, leaves the strain on the material unchanged.

This is the speciality of the cone, looked at as a self-sustaining roof-structure. But I can still go much further in economy of material. I have taken away half the cylindrical weight, I am going to take away more of what remains; this I do by diminishing the thickness of the plate uniformly towards the top: when I have done this, only one-third of the whole material of the cylinder remains in the cone, and the maximum strain is still everywhere less than one-third of a ton to the inch. My cone is, therefore, in material only one-third of a vertical round ring on the same base, having the sloping radius of the cone for its height, and its strength and strain per square inch are nowhere greater, and are everywhere less, than in the vertical ring. The crushing strain along the slope of the cone is, therefore, extraordinarily small.

The Tearing Strain.—The strain that architects most fear in roofs and domes is the stretching, or tearing strain, which stretches or tears asunder the supporting walls, buttresses, arches, or ties. This tearing strain is readily conjectured to be the great danger in the cone. That this roof should stretch and tear asunder, especially at the lowest ring or outer edge, seems the general first impression made on mechanical minds. That impression leads naturally to the wish to make the outside of the cone extremely strong. Some of my mechanical friends think that there are buttresses all round to resist this. They are not aware that the things they think buttresses are really hung from the roof they seem to uphold.

A simple way to think out the tensile strain of the cone is to study its change of shape as it is conceived to be flattened out. Take my original formation of the cone—thirty triangles soldered together in one; now lay them out flat by pushing down the top and swelling out the bottom, and watch the changes: 1st. The radius of the cone here is increased. 2nd. All the conic triangles are sundered, the spaces left between being triangles all with a common summit. The base of the cone was 1,080 ft. round, it is now 1,256 ft. round; it has stretched 176 ft., or the vacant space forming the base of the triangles of extension is near 8 ft. Call then each of these triangles 8 ft. at the base. If the cone had been india-rubber, each triangle of 36 ft. material would now be stretched 8 ft. out, or have got a base of 44 ft., *i.e.*, stretched 4 ft. a side. Now, mark the variation of this stretching. Outside it is 8 ft.; but 25 ft. up it is 7 ft.; 50 ft. up it is 6 ft.; 75 ft., 5 ft.; and so on, 4 ft., 3 ft., 2 ft., and 1 ft. In other words, the stretching out is perfectly equal on the triangular web all the way up. In exact proportion as the web narrows does the quantity of stretch diminish. Everywhere, therefore, along the web, from side to centre, the stretch is the same proportion to the length of web stretched.

This is as true of a stretch of 4 in. as of 4 ft. In all degrees of stretching of this cone, in its descent from 30 degrees to a dead flat, the stretching consists in an opening up, which is perfectly uniform along the whole of the cone, from bottom to top. In other words, a force putting the whole cone into stretch by bringing down the top and swelling out the base, makes a perfectly uniform stretch of the whole matter of the cone, from apex to circumference.

In short, the whole material is in uniform stretch throughout; but if all the material suffers uniform stretch, that is equivalent to saying that the whole material equally co-operates in resisting this strain. That is so: every atom of matter in the cone is equally strained; every atom of matter in the cone helps every other equally to resist the common strain; each bears its own share of the common burden. Thus, then, there is neither waste, defect, nor antagonism; the whole cone is in uniform tension, from top to bottom, and all round.

Supposing, then, a uniform pressure of water, or a uniform fall of snow, to press down the cone top and press out the cone base, it would meet everywhere a uniform tension of iron ring opposed to it. On each ring of iron would press a ring of water or snow, smaller as the ring was smaller, larger as the ring was larger, and as in my cone the thickness changes with the distance from the top, so will the pressure thicken, the weight and the stretch go together in permanent proportion from summit to base, each ring carrying its own load by its own strength, and all equally strong and equally strained.

I have asked myself what is the greatest strain its own weight could bring on my cone to stretch it. I hang up my cone in the air so that one half shall carry the other. I find 2,000 tons carried 2,400 inches, a gain not 1 ton to an inch; but that is an extravagant case.

We thus see that the whole cone is a series of straight-lined tapering bars, starting from a circle and meeting in a point, all of them in compression endways by their own crushing weight. We see that at the same moment the whole cone is a series of circular hoops, increasing in thickness as in diameter, and carrying a strain as hoops, all ways proportioned to the size and strength of each hoop, and increasing uniformly from top to bottom—in size, in strain, in thickness, in strength.

The Combined Strains.—The third important view of this subject consists in looking at these two strengths and strains together.

(1). Note. It is the same matter which bears simultaneously the two strains. Each bit of iron is a bit of the straight tapered bar, and stands a crush, and is a bit of the round hoop, and stands a tear. Now these two are neither in the same direction so as to conspire, nor in opposite directions so as to counteract each other; one is at right angles to the other; each does its double work, without interference. This is very remarkable.

(2). Note. Each atom is crushed one way, torn another way. The same atoms work two ways at once.

(3). We may now see how this might end. Let us suppose the cone a perfect whole of homogeneous metal perfectly constructed, uniformly loaded, mathematically and physically uniform. Let us next suppose it to be systematically and intentionally loaded to destruction. What would happen?

This is the answer: there would be a loud explosion, every atom would be crushed to dust one way and dispersed into invisible particles the other way. Whether what remained would be a liquid or a gas we cannot say, only as iron it would have disappeared; its cohesion ended and its repulsion ended, we have its complete exhaustion and annihilation.

In other words, we should have used up all its possible powers of substantive matter. What more than this can you ask philosopher, or engineer, or architect to do with the matter God has given us? Can more be possible? This cone then gives the greatest possible amount of working power out of a given quantity of matter.

Applications and Modifications: Conic Skeletons.—Forms, uses, and modifications of this conic principle of structure are manifold, and as they all receive from and throw light on our discussion they deserve study.

I. *Difference.*—What is the relation of a perfect cone to a conic skeleton?

It is one of the peculiarities of the cone that it is a "self-contained" structure; in other words, that much of it may be taken away, or injured, or displaced, without destroying it. I may take my perfect cone, and pierce it full of round, square, or triangular holes all over, and it remains stiff, stable, strong, and self-supporting. Nothing is harder than to destroy my cone. You may cut away its centre, *i.e.*, take out the keystone, it will stand all the same. You may cut the outer ring through in many places, the cone will stand. Its power of enduring abuse, distortion, and deformation is surprising. I do not think the artillery of an enemy could, in any reasonable time, destroy it. Nevertheless, I am obliged to say that all modifications of it are weaker than itself. One modification I very early made. I think it good for many uses, especially on a small scale. I call it the skeleton cone. It may be very simply derived from the continuous cone by the following method:—

Suppose you choose to cut away a large portion of the surface of the cone, leaving the intermediate parts all connected together, no matter what the size or shape of the apertures, you may still leave a perfectly balanced self-contained structure. This skeleton cone may be very conveniently formed of iron; of iron and glass; of iron, glass, and wood; or of iron and wood, in a variety of ways, and will admit of an infinite range of fancy in its applications.

One of the earliest applications I made of my discovery of the conic structure, was to communicate it to an esteemed architectural friend who had a probable occasion to use a large span roof. We designed it together on the skeleton principle; but it was not executed, for the ground was otherwise utilised.

Now I have to observe of skeleton conic structures, that they are light, strong, and convenient, for a multitude of purposes; that I recommend them as stronger, cheaper, and nobler than common trussed roofs; but as the scale grows larger, the continuous conic roof increases in value, and the other loses.

To explain the true principle of the continuous roof and the skeleton, it will be best to cut out the skeleton from a continuous cone. Take the cone already given. Select a portion of it covering say nine square yards, making (nearly) a square three yards on the side. Cut out the central square, you get an opening of nine square feet, with eight yards of continuous material all round it. Let us say you save a yard of iron, or one-ninth of the whole.

Let us now see by how much this saving of one yard weakens the structure. In the vertical direction which endures the crushing strain, you have removed one-third of the whole strength. In the circular or stretched horizontal strain, you have also removed one-third of the whole strength. Your saving is one-ninth; your loss is three-ninths, in a two-fold use. You have, therefore, done harm and made waste.

In this example I have cut away only a small opening. Let us next make it great. Instead of 1 yard in 3, let us make it 9 ft. in 11 ft. I cut away 9 ft. in 11 ft. I leave $\frac{2}{11}$ of the strength first vertically, second horizontally. My saving of material is 40 in $121 = \frac{40}{121} = \frac{3}{4}$. I save $\frac{3}{4}$ of the material. I cut away $\frac{9}{11}$ of the strength. In round numbers, the saving is $\frac{22}{88}$; the loss is $\frac{29}{88}$,—I save 22 and lose 29. The saving is also in only one item,—weight, 22. The loss is in two items,—stretching strength, 29; strutting strength, 29. Much, therefore, as a skeleton cone is a stronger, simpler, cheaper structure than a trussed roof structure, it is always inferior in strength, stability, endurance, and economy, to the perfect cone.

There is another way of looking at this, which is even more striking,—not to try to save material, but to gain strength. For this purpose, I cut away the same material out of the cone, and add what I cut away to the skeleton. In the first case, I cut away $\frac{1}{9}$; I spread that $\frac{1}{9}$ over the eight surrounding squares; I therefore add $\frac{1}{8}$ to the strength, from which I cut away $\frac{1}{9}$,—in other words, I take away $\frac{8}{72}$ of the strength, and add $\frac{9}{72}$, $\frac{1}{72}$ of dead loss! In the second case, I cut away $\frac{9}{11}$ of the strength. If I add this matter to the remaining $\frac{2}{11}$, I make it $\frac{9}{11}$, so I weaken it by $\frac{9}{11}$, I strengthen it by $\frac{1}{11}$,—a dead loss of $\frac{8}{11}$, or 40 per cent., in the strength. It is plain, therefore, I trust, that the continuous cone is the maximum of strength; that the skeleton cone, although much stronger than the common structures, is much weaker than the continuous cone. The conic family, nevertheless, presents manifest advantages, in different degrees.

Practical Application of the Cone at Vienna.—As all structures are not perfectly adapted to all purposes, it is manifestly the duty of the architect and engineer to use each to the end it serves best. Practical duty is a compromise between what one would like to do and what one has got to do. One makes knowingly and reluctantly a sacrifice of what one cannot help, for what one is bound to achieve; whence there are many cases in which one may sacrifice the perfection of the cone for the convenience of the uses. For some such an aim I have been willing and ready to use a mixed structure of continuous cone and detached skeleton on large structures. My Vienna cone is such a compromise. It has the merit of a complete continuous cone. It has also the convenience of a skeleton cone. It will be necessary to go into much further detail before explaining how and why this is done.

COLUMNS, WALLS, FOUNDATIONS, AND ACCESSORIES.

There are two different ways in which a conic roof may be applied. It may cover a round building, with a continuous brick or stone wall, as was first intended at Vienna; or it may have to stand on the summit of detached masses of masonry; or it may have to rest on mere isolated columns:—

1. If the cone is carried on a level, even mass of continuous masonry, all its peculiar virtues in strength and economy are utilised to the utmost. So long as the foundations do not give way, and the surface on which the cone rests is true to the surface of the cone resting on it, the effect corresponds to the theoretical result we have examined of best possible. If, however, the surface becomes irregular, if the foundations or wall give way, the case changes, and must be met.

2. If the foundations or the walls give way, the cone may be employed to give them strength, to keep them in place.

3. If the walls are removed, and the cone has to be carried on columns, the cone may be so formed as to give the supports and columns which carry it all the stability and strength they require.

This last case is the actual case of the Vienna cone. It was meant to have continuous stable walls of brickwork or masonry. This became difficult from want of materials and time. It was next to be supported by columns having narrow fillings between, giving them lateral stability. This, too, was abandoned.

Finally, it was settled that the cone must carry itself, must rely on itself alone for stability, must also carry all the strains of every thing round about it. As for foundations. It has to rest on alluvial soil, and all it can obtain is a concrete footing for each isolated column to stand on. The cone, therefore, has not merely to stand itself, but to give stability and strength to everything else, and to stand the stress of all about it. How a conic roof shall be so constructed as to maintain its own continuity and strength against the yielding of foundations and feebleness and discontinuity of support, and how the cone shall communicate its own strength and continuity to its supports and annexes, is a large new problem.

4. If we take first the case that the edge of our cone has to rest on detached points, set 36 ft. apart from each other, we must soon see that a plate of iron half an inch thick in a round ring will at once be bent into an elastic drooping curve between the columns; in short, that the cone is no longer a cone.

5. The problem becomes this, therefore:—How to prevent the cone from ceasing to be a cone under the distorting forces now brought to bear on it. To do this we have to provide that at all the points where the distorting forces may be applied it may find the cone too strong for them.

6. Fortunately for us the very nature of the cone supplies the simple and methodical means of doing this in a way of most easy execution. The cone is straight one way, circular the other way. We have only to see that the straight lines are held straight and the round ones kept round, and all the strength in the cone remains.

7. As regards the straight line strength. Each detached column will tend to buckle up the cone at the place where they meet, or to bend the straight ridge into a curve. To counteract this we must place a stiffening plate running up from the top of the column, and pointing towards the summit of the cone. This need only be an ordinary stringer or straight girder.

One of these straight stringers must go from the head of each column and point towards the summit of the cone. It is convenient to call these Ridge Girders, to distinguish them from a second sort to be called Ring Girders.

8. As to the circular strength. Each detached column will tend to distort the cone, by giving it a curious and interesting form, which is very beautiful, but wastes its strength. This distortion would be repeated at every column all round.

Happily there is a geometrical and mechanical resource, which is the direct antagonist to this distorting force. Each cone has what I may call a supplementary cone. A small ring of this supplementary cone counteracts the distortive power of each column in the circular direction. All the ring girders in my cone are rings taken out of this supplementary cone. The supplementary cone is geometrically one whose vertical angle makes, with that of the chief cone, a complete sum of 180°.

Ridge-girders and ring-girders are therefore the antidotes to the distortive and destructive forces which unreliable foundations, irregular support, or detached isolated columns apply to destroy the continuity and geometry of the cone.

Earthquakes, Hurricanes, Avalanches.—There is yet another set of forces distortive and destructive of the cone to be kept in mind—an earthquake, a hurricane, an avalanche.

Earthquakes, as far as I have watched their effects in the East, are the architect's most deadly enemies. Nevertheless, the dome of St. Sophia, at Constantinople, has wonderfully withstood them. This I attribute to the fact that, in my view, the dome is built on an entirely different principle from what is generally considered as the principle of the masonry dome. I am not aware that there is much to fear from earthquakes at Vienna; nevertheless I have done my best to strengthen my cone even against them. The means, however, are of the same nature as strengthening against a hurricane.

The hurricane and the earthquake are in some respects the same in their mode of destruction. The earthquake shifts the ground from underneath horizontally away from under the roof weight, so as to leave some load in a position of instability. The hurricane shifts the roof weight away from over the supports, so as to cause instability. The practical effects of both are analogous.

There is one way to ensure the stability of a domic roof resting on columns; that way I have already in part described in the structure I have given to the roof, in ring-girders and ridge-girders traversing the cone through the summits of each column. These I applied to prevent distortion of the cone by the columns under the action of local disturbing forces.

I must now open up a somewhat larger view of the subject by showing how I can bring all the strength of the cone to bear on the columns, so as to give them and itself perfect stability independent of bad foundations, shifting foundations, shaking earthquakes, and shaking hurricanes. My cone is so contrived, that if you knock away the foundation of a column, the cone will support the column in its place, and the column will support the arches that spring from it and the outer roof that hangs from it, even when the foot of the column hangs in air! My cone is sufficiently strong to carry even two or three adjacent columns with their foundations fallen away. My cone is so contrived, that if by an earthquake the foundations were moved horizontally, the columns would not follow them, but would maintain their upright positions in their correct places under the dome. If a hurricane could be conceived strong enough to shift bodily along out of place the whole 4,000 tons of dome, the columns would shift place with the dome and carry it as secure as ever in the right place!

The secret of this quality consists in a principle I have not yet adverted to. The perfect homogeneous cone has a remarkable characteristic which is well known geometrically since the early ages of geometry. This characteristic is, that its whole surface consists in a continuous series of parabolic chains, or approximate catenaries, in places parallel with the slope of the cone.

Now, these parabolic catenaries have this quality, that they connect the summit of each and every column with the whole of the opposite, as well as with the adjacent, side of the cone. Each column is, therefore, held in place by the equivalent of a countless number of chains ending in the summit of the column, and pressing with a uniform, even-spread, gentle pressure on the skin of the cone, on one side, and also on the opposite place. The weight of the cone on one side answers the columns on the other, by a series of "iron chain cables," or parabolic catenaries.

But further: each vertical section of the whole conic surface is a hyperbola, approximating closely to the inverted catenary, or catenarian arch. If, therefore, you knock away one, two, or three columns, or their foundations, the mutilated cone still stands upright on all the other columns, standing on a series of catenary arches, extending across the whole skin of the dome to the surviving columns, and supporting the roof by catenary equilibrated pressure.

My conical roof, therefore, contains within its strength enough to resist all the strains which can fall upon its supports and connexions, and that strength communicated to them through the best possible ways. To utilise this strength one more condition is necessary, which I have not yet pointed out,—that is, the perfect unity of the superior structure, or roof, with the inferior structure or supports. In a common building the supports, columns, arches, walls, find their strength in broad and deep foundations, whence they carry stability up to the roof. In my building all the stability is derived from the roof, and is given off into the supports by a connexion to which I must now direct attention.

The roof rests on thirty, or say thirty-two, columns, for there are two small side arches at the main entrance. These thirty main columns are neither square nor round. They are 10 ft. through one way, 4 ft. through the other way, and 80 ft. high. They are of the same material as the cone itself, combined in the same proportions, and united in the same way. They are in structure, though not in shape, part of the cone.

The reasons for the position and proportions of the columns are the following:—If the columns had been placed the broad way round the circle, they would have formed part of the wall inclosure, and would also have given more

direct support to the edge of the cone. But in this case they do not form an outer wall, they are inclosed in the circular aisle or alley, which is 40 ft. wide, 80 ft. high, and goes right round the building, enlarging its diameter from 360 ft. to 440 ft. In this position they do not serve as walls, and placed circular-wise the columns would obstruct the view of the dome from the aisles, and of the aisles from the dome. This is one reason for their radial position. But there is a weighty mechanical reason for this position, which will be recognised by studying the top of the column at its junction with the cone. Here it will be seen that the column carries the cone, and also carries the outmost ring-girder, and in this way extends its support continuously round the edge of the roof, and thus dispenses with wall support. Its longer dimension stretches radial-wise towards the cone axis, and spreads out from 10 ft. to a breadth of 20 ft., where by a circular curve it joins the cone. Not only does it join the cone at 20 ft. within the circumference, but throughout this distance it becomes incorporated with the ring-girder, through which it is continued along the slope of the cone upwards towards the apex. Besides, at the same place there is placed a second ring-girder, expressly set there to receive the pressure of its inner edge, and spread its pressure round the cone. The column thus becomes one with the cone itself, one with the system of radial girders, one with the system of ring-girders. Thus each gives strength to all, and all give strength to each.

Destruction of the Cone.—It is now, I hope, plain why the whole structure, which merely rests its weight on the ground derives no lateral strength, or stability, or power of resistance from its foundations. These are mere slabs of concrete which rest on the alluvium of the Danube, and prevent the weight of the dome from sinking down into it. The columns, spreading out above by ribs and rings over the surface of the cone, may be said to grow downwards from spreading roots above, and merely to rest on the ground, as a lame man's crutches, or as the legs of a table on a smooth floor. Their strength comes from above, not from below. They lend their strength to save the strain of all above them, and they get in return the strength and strain of all above them to maintain their position below. No parts can fall unless all else fall along with it.

To conclude this exposition of the special principles involved in the construction of this Vienna cone, I must beg leave to ask you to take a parting look at it from quite another point of view from that in which I have thought it necessary to introduce it to your consideration. I may in some points have failed to make the principles I have laid before you convincing to your reason,—I may, perhaps, have failed to make you feel quite certain of the inevitable strength and permanent stability of my structure as a whole. I beg you, therefore, to accompany me to a new point of view, and thence to look back on the whole cone as a completed structure, and from the outside let us look at it as mechanical critics, and see if we could invent a plan how to make the building fall. For this purpose I shall "defy" the enemies of the building to make it fall. Let them imitate the enemies of the *Great Eastern*. They blew her up, but she held together! They ripped open her bottom, but she safely crossed the ocean! They abandoned her to a hurricane, but she rode it down! Now, in the same way let us conceive the enemies of the dome trying to destroy it. A friend of mine and myself have already performed that war on a small model. We got it made of metal, true in all its proportions. We blew it up; we squashed it down; we tore it asunder; we buckled it in. At last, by the use of forces out of all proportion to its own weight, we cruelly defaced, deformed, and distorted it. Nevertheless, this deformed, defaced, diabolically-injured form remained one complete, self-relying, self-contained structure, and satisfied me that it might be cannonaded, blown up, cut down, undermined, and would still retain strength, stability, and endurance.

Looking, then, at it from the outside, let us suppose it cannonaded by a naval battery of shot and shell. What would they do? They would simply go through, exploding within, and leaving large holes behind them. And these holes, what harm would they do? They would merely do this: make out of the continuous cone a skeleton cone. The skeleton cone would, as I have already shown, be a weakened cone, but but still stable and self-sustaining.

We will next allow the enemy, become savage by failure, to scale the dome, and at leisure with hatchet, hammer, and chisel, try to cut it down. Led on by scientific engineers, they will attack the stronghold and try to destroy that at its weakest point. Now, the enemy think that the cone takes all its strength from the outer round ring. They think that is the one hoop of the cask, and that when that is cut through all the other parts of the edifice will fall asunder like the staves of an unhooped cask. Let us, therefore, give them full swing and follow their work of destruction. They mount the roof. They use an army of hammerers. They cut through the entire outer ring between the two entrance columns, over the centre of the arch, and they expect then to see the keystone of the arch fall out, and the whole series to tumble like the Barentin viaduct—a similar succession of arches. There one arch broken brought down all. Here, as we stand still, we see the main arch cut through; but everything stays as it was! Why? Because all the other parts conspire jointly to keep it where it is — it is firmly held there and cannot budge!

Let us now try another plan. Let us cut off these other arches and columns from coming to the rescue. Let the enemy go on and sever arch after arch all round the outer ring until the outer ring is cut through into thirty separate parts! Of course it is no more a ring—it no more does work as a hoop. Why do not the arches fall? Why are not the columns upset? Why does not the roof go squash down? The reason is, it cannot budge. Reserve forces far behind of which the enemy has no conception of the existence or whereabouts, come into play, and the wounded abused building holds its ground.

Perhaps you will say this is the severest test it can be put to, and no more can be done. It can stand still more. You have cut away the outer ring, and it stands. You may go further, and you cut in thirty pieces the second ring. The building stands. You cut through finally the outer cone itself into thirty sections, where it lies between the outer rings; leaving, if you think, thirty clear wounds of 30 ft. long each, right through cone, rings, and all. The whole building still stands fast. The enemy, disappointed in his aim, will not yet say he is beaten. He will say that he has only proved too much. He thinks that he has shown that the severed rings and the severed cones were no use as the building stands without them! He will not, however, get you, I trust, to agree with him. He has only shown that my reserves of strength were too powerful, and that he did not know they were there.

The secret of these reserves I now betray to you—it was the root at the top of the columns, and the catenary chains and arches in the central body of the cone, which were the secret reserves he wot not of, and they held all in place after his destruction was done. These saved the cone, and with these it is still in shape and perfect balance. The cone, therefore, will stand after it is pierced through all over; after its outer and inner rings are cut through; after the outer chain of the cone itself is severed. Indeed, after it is severed into thirty detached fragments it will still stand. Only complete disintegration can bring it down. Indeed, it would cost more time and labour to cut it to pieces than to build it in place.

DESTRUCTION OF THE PANTECHNICON, BELGRAVIA.

The destruction of this very large building, of which every one has by this time heard, is complete; nothing remains but the walls, and these are for the most part so weakened as to require to be taken down. The evil of wood bond and plates, often before alluded to, is again made obvious, every bit of such introductions being burnt out, of course to the injury of the walls.

The *Times*, quoting its issue of May, 1831, says the building was at that date divided into two main blocks, communicating with each other, and occupying over an acre and a quarter of ground. Since that time much of the adjacent property has been absorbed, and added to the Pantechnicon, so that the area of occupation was not much less, if at all, than two acres. The north building, which was the first finished, was, on competent authority, said to be the completest thing in its way ever constructed, and neither ingenuity nor expense was spared to render it perfect for the purposes for which it was intended. By means of peculiarly-formed and solid iron pillars, a complete iron support was produced from the ground through the intervening floors to the roof. The whole of the ceilings were lathed with iron rods, and covered with a composition which, as was then hoped, would resist the fiercest fire, and would not crack or fall down if water was thrown upon it while hot. The boarded floors were covered with iron plates laid upon patent felt to preserve the under side of the iron from rust, and to deaden the sound. The rooms were separated from each other by brick walls and wrought-iron doors, and the stairs were all of stone. All the chimney flues were lined with cast iron, and there was not a piece of wood exposed in any part of the building itself. Some hundreds of tons of iron were used in the erection of that portion of the premises. The south building was afterwards similarly and as substantially constructed.

Where is the iron now? Strewing the ground in bent and broken pieces; the iron shutters, where they remain, twisted up like a sheet of brown paper: not a floor saved.

We have so often after great fires sought "to improve the occasion," that nearly all that can be said on such a subject may be found in our volumes. And quite recently we have printed useful observations of others on the subjects. Still we shall have to come back to it before long.

The amount of loss at the Pantechnicon has not yet been correctly estimated, but will be found enormous; part of it being property of that character, namely, works of art by old masters, for which no amount of money can compensate. Year by year the priceless treasures of past time are swallowed up, to the loss of the world.

Directly the new Parliament meets it is to be hoped that some member will move for a precise return of the measures adopted in all our public buildings and galleries for the prevention of damage by fire, with a view to the adoption of the most complete arrangements possible in that direction.

Sir,—This is another instance of the danger of storing valuable goods in large quantities in one building; had it been erected in separate blocks a portion only would have been destroyed.

In the rebuilding I would recommend that it be divided, having an open passage-way between each division of about 5 ft., and not any openings in flank walls.

In the large fire in Tooley-street a few years since, the warehouses were only divided by party-walls and iron-doors, hence the great extent of that fire and immense destruction of property.

At this time there are dozens of warehouses by the river-side filled with inflammable goods and only separated by party-walls, and fireproof-floors, as they are called; these, in large fires, get red hot, and the fire extends to the building adjoining till there are no more goods to burn, and the enormous body of fire carries all before it.

J. D.

THE ARCHITECT OF THE IRISH PARLIAMENT HOUSE.

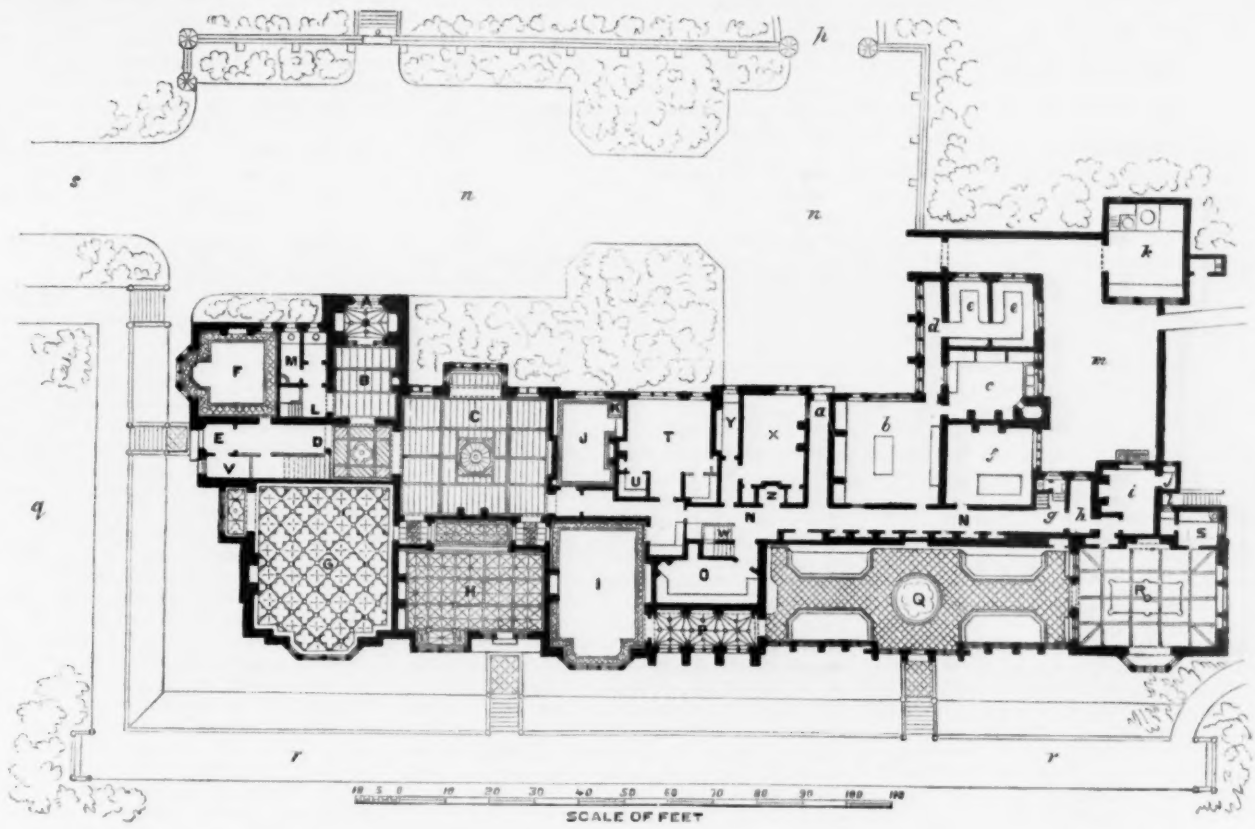
Sir,—About two years since one of your correspondents inquired of you for information as to "Sir Edward Pearce," and I wrote to you that he was a brother of General Sir Thomas Pearce, who was governor (mayor) of Limerick, and commander-in-chief in Ireland; and, further, that he was architect of the Houses of Parliament. I spoke only as according to the traditions of the family; you were wise enough to describe him as *one* of the architects, &c.

Recently, I have come across a book, entitled "Limerick: its History and Antiquities. By Maurice Lenihan." In this work the author relates that Governor Pearce, according to an Act of Parliament then recently passed, sentenced to death and hanged the "first" priest who was found guilty of the "crime" of marrying a Protestant Man to a Roman Catholic woman.

At the foot of the page is a note by the author, as follows:—

"This was a stain on the reputation of General Pearce, who was the brother of the distinguished Sir Edward Lovet Pearce, the architect of the magnificent Irish Parliament House. Sir E. L. Pearce was at this time engineer and surveyor-general of the king's works. He obtained a sum of 1,000*l.* from the Commons, and an address from the House of Lords, in Ireland, 'for his skill, true ability, and good workmanship, in building the Parliament House in College-green,' an edifice which was then, and which continues to be, the admiration of Europe. He had been a captain in Nevill's regiment of Dragoons, and sat in the Parliament of Ireland for the borough of Ratoath."

J. P.



REFERENCES.

A. Entrance-porch.
B. Vestibule.
C. Hall.
D. Principal staircase.
E. Garden entrance.
F. Boudoir.
G. Drawing-room.
H. Library.
I. Dining-room.
J. Own room.
K. Safe.
L. Servants' stairs from basement (to open front door).
M. Lavatory, &c.
N. Corridor.
O. Gun-room.
P. Groined cloisters.
Q. Old conservatory (re-arranged).
R. Billiard-room.
S. Lavatory, &c.
T. Butler's pantry.
U. Glass.
V. Hats, &c.
W. Servants' stairs.
X. Housekeeper's room.
Y. Stores.
Z. Lift.

a. Servants' entrance.
b. Kitchen.
c. Scullery.
d. Passage.
e. Larders.
f. Servants' hall.
g. Men-servants' stairs.
h. Entrance.
i. Knives and boots.
j. Men's W.C.
k. Brewhouse and washhouse.
l. Steps to vaults.
m. Courtyard.
n. Entrance courtyard.
o. Steps to high ground.
p. Back road.
q. Croquet-ground.
r. Terrace and flower-garden.
s. Principal entrance (roadway).

NUTFIELD PRIORY, NUTFIELD, SURREY.——*Ground Plan.*

NUTFIELD PRIORY, NUTFIELD, SURREY.

IN a recent Number,* we gave a view of this mansion, which has been erected for Mr. Joshua Fielden, under the direction of Mr. John Gibson, architect. We now give a plan of the ground floor, as then promised, with such references as will sufficiently explain the appropriation of the various rooms.

NOTES FROM DUBLIN.

THE planting of the trees (the *platanus* or plane tree) in Sackville-street, the widest and finest of the Dublin thoroughfares, is nearly complete. It is thought that when they are in proper trim and foliage they will add much to the appearance of the street, by giving it the features of the Parisian boulevard. The specimens selected do not seem to be of the best, as not a few of them are far from being clean-stemmed. They are put down close upon the gas mains, and stand about 10 ft. high and 15 in. from the flagway. An iron guard protects them. Rich fibry loam for the roots to ramify in, was supplied from the Phœnix Park, for which the committee were indebted to the kindness of Mr. Hornsby, of the Board of Works.

The corporation are busily agitating for the removal of Nelson's Pillar, situated half-way in the centre of Sackville-street, near to the General Post-office. This triumphal column was erected in 1808, three years after the Battle of Trafalgar, and was from the design of William Wilkins, architect, of Caius College, Cambridge. The original cost of the erection amounted to the sum of 6,856*l*. William Kirk was the sculptor of the statue of the Admiral that surmounts the column. Some are for removing the pillar to St. Stephen's-green, the largest square in the city, and others think it should be placed in the Phœnix Park. A third party advocates a new site at the head of Sackville-street, near to the Rotunda. A subscription for the removal is proposed, which it is computed could be accomplished for about 1,500*l*. Like the Northumberland House proposal, some over-sanguine individuals are suggesting the American screw-jack and rolling principle, forgetting that the total height of column and statue is 134 ft. 3 in. The column certainly obstructs the view of the entire street, and dwarfs the proportions of the Post-office, the work of Francis Johnston. The certainty of its removal is, after all, a very doubtful question in the present generation.

New Epidemic Wards at the Meath Hospital have been completed at a cost of 800*l*., and alterations and additions are in progress for converting the flax-mills, situated at Chapelizod, belonging to Messrs. Darger & Co., into a distillery. Extensive alterations to the collector-general's office, Fleet-street, are also taking place. These with some other minor public and domestic works proceeding, are from the designs and under the superintendence of Mr. E. H. Carson, architect.

At a special meeting of the corporation, a matter was brought forward by Mr. Norwood, that it be referred to a committee of the whole house to prepare a memorial to be presented to her Majesty's Government praying the application of a portion of the Surplus Church Fund to the effectuation of the rebuilding of Carlisle Bridge, Dublin, the formation of the new street from Cork-hill to Christchurch-place, and such other public works and improvements as have already had the sanction of the council, or may in their judgment be necessary for the adornment and improvement of the metropolis, and also to the drainage of such districts in Ireland as may require the same, the purchase and reclamation of waste lands, and such other purposes as may be useful. The motion was carried, but the citizens will have to wait long before they see the realisation of the projects, if they do not themselves move.

En passant, the Lord Mayor, on being congratulated on his election as M.P. of the city, administered a quiet but pertinent rebuke to some members of the town council, whom the cap fitted. He hoped that, during his year of office in the civic chair, no one would know his politics as far as his duty lay in the corporation. The municipal body, he considered, was not the place for the discussion of politics, and that such matters ought to be left in the background by members. It is to be hoped that the corporators will take the advice, and devote their energies to the sanitary wants, and other urgent improvements the city stands so badly in need of.

At an inquest held upon the bodies of two children, the father of whom was an Englishman, it appeared that the premises held were lately occupied as offices by the Registrar General, and by the father of the children, and that for some time a wholesale corset manufactory had been carried on by him. The manufactory had been discontinued, but the father with his wife and three children continued to reside on the premises. The ground-floor of the building consisted of a series of fire-proof rooms, fitted up for keeping records. The landlord availed himself of these rooms and stands for the purpose of forcing mushrooms, and beds of stable-manure were placed on the floor, and on the stands in tiers, and it was alleged that the emanation from these beds penetrated the flooring into the rooms above and so vitiated the atmosphere as to accelerate the children's deaths.

At a general meeting of the Royal Irish Academy, held this week, among the papers read was one by Mr. R. R. Brash, architect, "On an Ogham Inscription from Mount Music, County Cork"; and another on the same inscription, by

* See pp. 50, 53, *ante*.

Samuel Ferguson, LL.D., Vice-President and Deputy Keeper of the Records.

The city is still in a very unsanitary state, and scavengers are few and far between.

GREEK ARCHITECTURE IN ROME.

AT the meeting of the British and American Archæological Society of Rome on January 23rd, Mr. Pullan chose Greek Art as the subject for his lecture, because it had some claim upon those who are studying the antiquities of Rome, since it was the source whence Roman Art was derived. The literature, painting, and sculpture, and more especially the architecture of Rome were derived directly from Greece, and the finest buildings of the eternal city were designed by Greek architects, and executed by Greek workmen, as for instance the Forum of Trajan by Apollodorus. The Romans were not a people possessed of inventive genius, but they understood the art of borrowing, and had the power of adapting in a high degree. They borrowed the arch from the Etruscans, and the orders from the Greeks; and by combination of the *arcuate* and *trabeate* principles they formed a style of their own, of which there is a perfect example in the Colosseum. The west coast of Asia Minor was colonised by Greeks, who invented the Doric and Ionic orders, and who carried their architecture to such perfection that the edifices erected by them were ranked amongst the seven wonders of the ancient world. These were the tomb of Mausoleus, king of Caria, and the temple of Diana of Ephesus. It was Mr. Pullan's lot to be appointed by the British Government, to take part in the disinterment of the remains of the former, and subsequently to take charge of three other expeditions of considerable importance, which resulted in the discovery of the temple of Bacchus at Teos, in 1861; of the temple of Apollo Sminteros, in 1865; and of that of Minerva Polias at Priene, in 1869. As in these explorations he had to take notes of every fragment found, he had the handling of the constructional stones of the principal Greek temples; therefore he was better acquainted with Greek than with Roman art. Hence he had chosen it in preference, and in describing the various buildings which had come under his observation, he would give some account of his visit to several of them, and the system adopted in the excavations; and he trusted that those details would tend to enliven what would otherwise be a dry dissertation upon a somewhat dry subject. The lecturer then briefly described the circumstances which led to the discovery of the site of the mausoleum in 1857. He read Pliny's description of the building, and, aided by a drawing, explained the manner by which he arrived at the restoration, which coincides exactly with Pliny's description. He then referred to the subsequent removal of the expedition to the city of Cnidus, and described the Lion Tomb, which seemed to have been the prototype of the mausoleum. He mentioned the manner in which the pyramid had been supported by a domical vault or *tholus*, constructed on the horizontal principle. He said that on examining the lower chamber of the so-called prison of St. Peter, he found that it had been originally a *tholus* of similar character, with the upper courses removed in Imperial time; and as a wall of the kings was built partly upon it, he concluded that it had originally been a tomb erected before the foundation of Rome, and, therefore, that it was the earliest piece of construction in Rome. Mr. Pullan then proceeded to give an account of his excavations on the sites of the three temples before mentioned, particularly alluding to the last, that of Minerva of Priene, where, though the difficulties he had to contend with, such as the interruption arising from fever and storms, were greater than in the former cases, the results were the more satisfactory. A Greek temple of a good period, that of Alexander the Great, had been laid bare (of this a photograph was handed round), and several inscriptions and pieces of sculpture were recovered, which are now in the British Museum. These expeditions were sent out by the Dilettanti Society, which was founded in 1736, partly with the object of promoting the study of Greek art. In conclusion, the lecturer advocated the study of Greek architecture as the ground after which the architecture of the future could be based.

The Ruins at Ephesus.—The Reverend Canon Ridgway being appealed to by Mr. Pullan as one who had visited the ruins of Ephesus, said that he unfortunately had been there before Mr. Wood had discovered the true site of the Temple of Diana; he had watched, however, the progress of the excavations, and had kept himself *en rapport* with what Mr. Wood had done, so far as could be gathered from printed communications. That building was of very great interest, both on account of its having been the culmination of Greek art, and the *acmé* of Greek idolatry. He thought it would be a most profitable subject of discussion, "To what extent Greek Art and Mythology had influence in the Art and Mythology of Rome." It must have struck others who had visited those two countries that the ruins of temples seen at the present day in this city were built after Greek models, and there could be no doubt that as soon as the Romans had subjugated Greece and Asia Minor, they became enraptured with the superior excellence of the architecture and sculpture, with which they saw those cities adorned, and at once they set themselves at work to remodel their capital. Art, taste, and religion became, in consequence, speedily elevated in tone. The rude massive temples of the republic were levelled to those foundations, whose recent discovery has been due to the indefatigable perseverance of Mr. Parker; their places occupied by more elegant structures copied especially from the Greek cities of Asia Minor, and a new ritual of worship to gods, hitherto strangers to Western Europe, accompanied a new era of architecture. Ecclesiastical buildings in Rome, of Imperial times, can hence be as certainly distinguished from secular as those of our own day. It was from this consideration that he was inclined towards Mr. Parker's opinion that the so-called temples of Venus and Rome had been misnamed, the existing ruins exhibiting less of the features of temples than of baths or market-halls; in fact, they seemed more Byzantine than Greek. The chief characteristic of a religious edifice amongst the latter was the colonnade. The Ionic column perfected, if not originated in the Asiatic colonies, was said to have owed its first conception to the contemplation of the female figure: the double roll on each side of the capital representing the plaits of hair on the head, and its gradual spread to the base, the flow of the garment that draped the human figure, the folds of which were subsequently portrayed by the fluting of the columns. He has been struck with a statue in the capitol, a copy of the Ephesian idol (so utterly unlike the Latin Diana) showing that both the form and culture of the Asiatic goddess had been imported into Rome. It was a very beautiful specimen in which the progress of art from one epoch to another was very visible; for the statue of Diana had advanced from the shapeless trunk, that was said to have "come down from Jupiter," into a most artistic figure. Its head was supporting a castellated entablature and the trunk was almost blossoming into an ornamented pillar, while the folds of the drapery were collected round the ankles (as if by an incipient string-course), and these fell in a bell-shaped roll, covering the feet, precisely like the torus above the square plinth of an Ionic column, revealing only the toes, which seem described as resembling the alternate keys of a piano. Not only had Greek architecture revolutionised Roman taste, but also, he felt convinced, the fanatic devotion of Asiatic archæologists would know how it was esteemed the highest honour amongst those Ionic colonists to dedicate and endow temples; how kings vied one with another, in such gifts and endowments; how whole cities sought for the privilege of being styled "Guardians" (Neokoroi or humble door-keepers) of this or that deity; how when the Roman power became supreme in the Archipelago, and the centre of the government was drifting towards Asia, its emperors easily coveted the distinction of presiding at the annual festivals which prevailed during the month of May, called "Artemision," from Artemis, the Diana of Ephesus. This president (officially styled Jupiter) was invested with Divine honours and attributes, was required to live for the season in complete seclusion in the temple, and to simulate immortality. It is recorded that one Roman emperor, having been thus treated with godlike reverence for a month, declined to return to mortality, abdicated the throne, and ended his life as a recluse. Thus flattered by their Asiatic subjects, they multiplied temples in their city, and we find on the Neokor medals (struck to commemorate these annual festivals) the head of the reigning emperor on the one side, the shrine of the deity on the other, while after the time of Augustus the old title of "Pater Patriæ" gave place to "Divus." This fanaticism spread to the citizens of Rome itself. An apotheosis, and subsequent temples dedicated to emperors, followed in due course, and one relic has survived unaltered to our own times, the present pope historically owing the title "Pontifex Maximus" less through being the ecclesiastical successor of St. Peter than to his being the political descendant of the Cæsars.

THE PATHS BY BUCKINGHAM PALACE.

FOR several years past there has been an increasing traffic through the park from Buckingham Gate across the front of Buckingham Palace to St. James's Palace, and also by way of the footpath leading to the steps opposite Devonshire House, Piccadilly. This open space by Buckingham Palace is as disagreeable as could possibly be for foot passengers, always either mud or dust: it is worn into ridges and furrows and hollow places,—in wet weather the surface is probably the dirtiest in London; in dry, windy weather it is all dust and grit,—when watered in summer it is mud again. It has lately had a small sprinkling of broken granite, which soon becomes worn down and dispersed. The footpath to Piccadilly is used more than any other in the park, yet it is the very worst for mud, &c., and, though used necessarily long after dark, there are no gaslights, and too frequently there are disagreeable people loitering about. The lights are in those paths where few persons ever walk. If our new Government will make this thoroughfare safe and agreeable, they will confer a public benefit, and remove what is now discreditable in front of a palace, which should set an example to owners of property in London. Private persons are expected to keep their frontage clean, and it is not too much to ask of the guardians of royal palaces to do their share of a public duty. H. C.

FIREPROOF CONSTRUCTION.

COMBINATION OF MATERIALS.

SIR,—General Pasley, in his observations on limes, water cements, &c., clause 134, records an experiment on a segmental half-brick arch, with span of 15 ft. 4 in. and rise of 9 in., being built between the walls of a casemate.

The 4½-in. arch was loaded with fourteen courses of bricks loosely laid and dry, estimated to weigh 8,960 lb., before it gave way; the containing walls gave the abutment.

Mr. J. H. Owen, in the *Builder*, p. 48, suggests division of floor-space into areas of about 15 ft. or 20 ft. square, carrying the bearing-points with cushions of brick standards, formed either with an iron skin grouted with concrete, iron of a cross section filled in with brickwork, or brick supports chamfered, the ceilings supported by an iron beam of rolled iron;—ceiling formed on the centre with tiles laid to the curve of the arch; the space between them and the tiles forming the surface of the floor it is proposed to fill in with concrete.

I venture to suggest the policy of forming the beam which carries the floor with brick arch at least 9 in. deep at the crown, kept from spreading by 1-in. iron rods of Lowmoor iron, if considered necessary, which rods should be kept at least 6 in. from the lower surface of the brickwork. Being thus cased by brick, which is a bad conductor of heat, and not easily damaged by fire, it would be nearly, if not quite, fireproof. If the appearance of the brick is objected to, it might be rendered with plaster of Paris, which is found to resist the action of flame.

The intermediate beams, like those in an old wooden floor, might be made of greater depth than the average thickness of the ceiling.

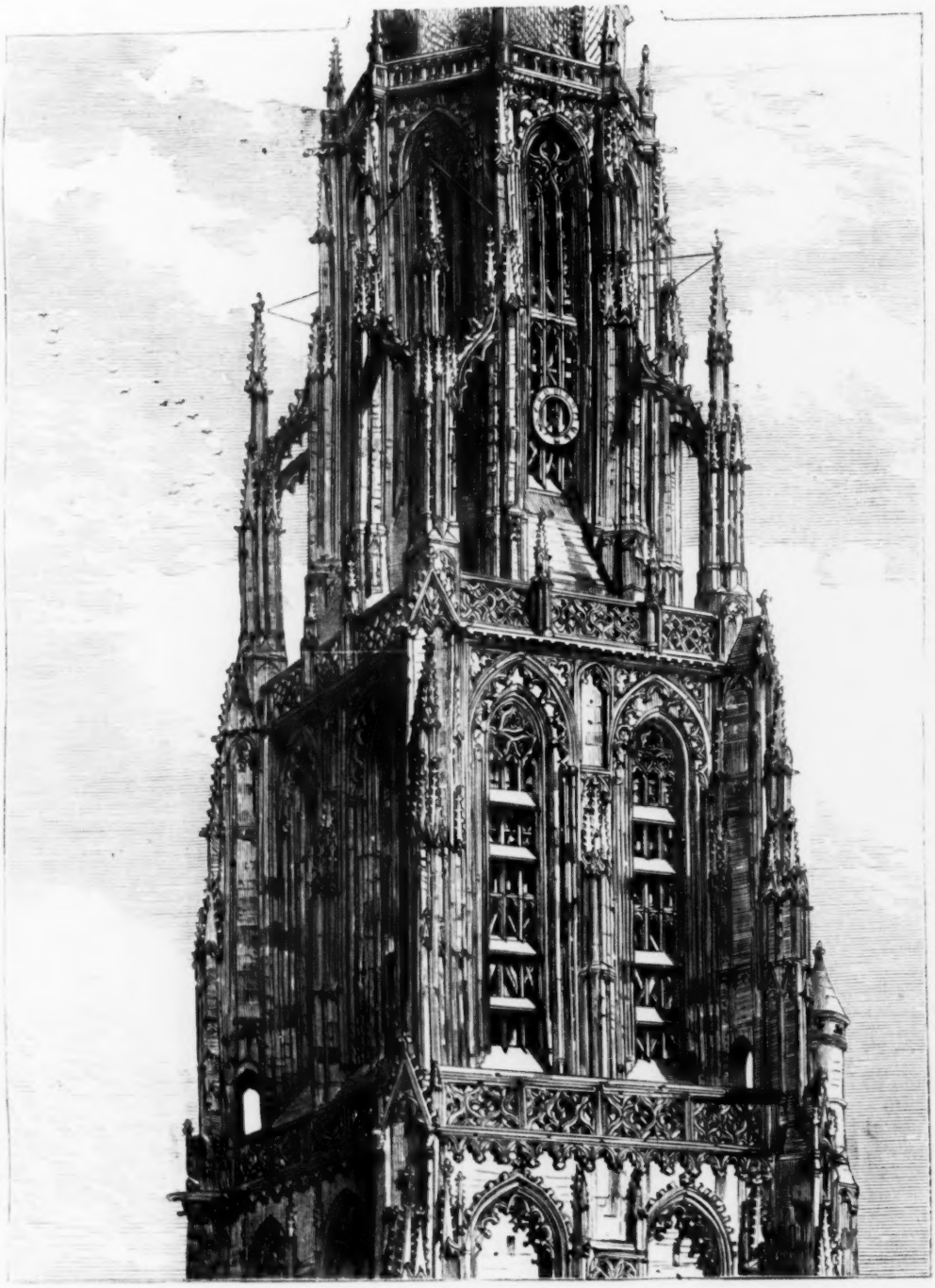
Portland cement, swelling rather than shrinking in setting, would tighten the retaining rods.

Probably working on this plan, the span of the arch might be largely extended with safety.

I suggested to the Society for the Organisation of Charity the erection of a few blocks of buildings for the lower strata of the wage classes, built on the same principle, *i.e.*, the ceiling and floor of the ground-floor room in one concrete and brick slab, the upper ceiling and roof in another. I thought the demand for cheap houses for labourers might thus be met.

If the retaining plate, through and against which the retaining ties tighten, have against them an inlet for external air, they cannot heat, as the draught will prevent it.

JOSEPH CHRETIEN.



TOWER OF THE PROTESTANT CHURCH IN BREDA, HOLLAND.

TOWER OF THE PROTESTANT CHURCH IN BREDA, HOLLAND.

The Protestant Church, formerly the cathedral, at Breda, in Holland, is a most noble building of the latest Decorated, with a considerable admixture of the Flamboyant or Third Pointed style, and some fine additions of the earlier Renaissance period. The choir of this church was consecrated in 1410, and it is probable that the magnificent tower and lantern are of a later date than this. Of course an Englishman looking at them for the first time would be inclined to give a much earlier date, but it must be borne in mind that the Netherlands were far behind us in the development of Gothic architecture, and retained it in great purity far longer than we did; indeed, many Gothic churches in Holland, and especially in Belgium, which appear at first sight to be works of the fourteenth century, were in reality only erected a few years before the close of the sixteenth century. It is, therefore, highly probable that the tower of the church at Breda was not commenced before the year 1450 or 1460, and the graceful lantern is twenty or thirty years later in date. This tower is the most beautiful in all Holland. Originally, there were two other lanterns superimposed above the lofty lantern shown in our drawing, but these were injured by a storm in the latter part of the seventeenth century, and replaced by a bulbous spire covered with lead and copper, which, although slightly out of place on a Gothic tower, is very pleasing in outline and has a good effect. The church to which this tower is attached consists of a nave and aisles, very deep transepts, and a long choir and aisles, terminating in an apse. Originally, the aisles did not surround the apse, but at the latter end of the sixteenth century arches were cut in the sides of the apse and a regular "chevêt" with radiating chapels constructed.

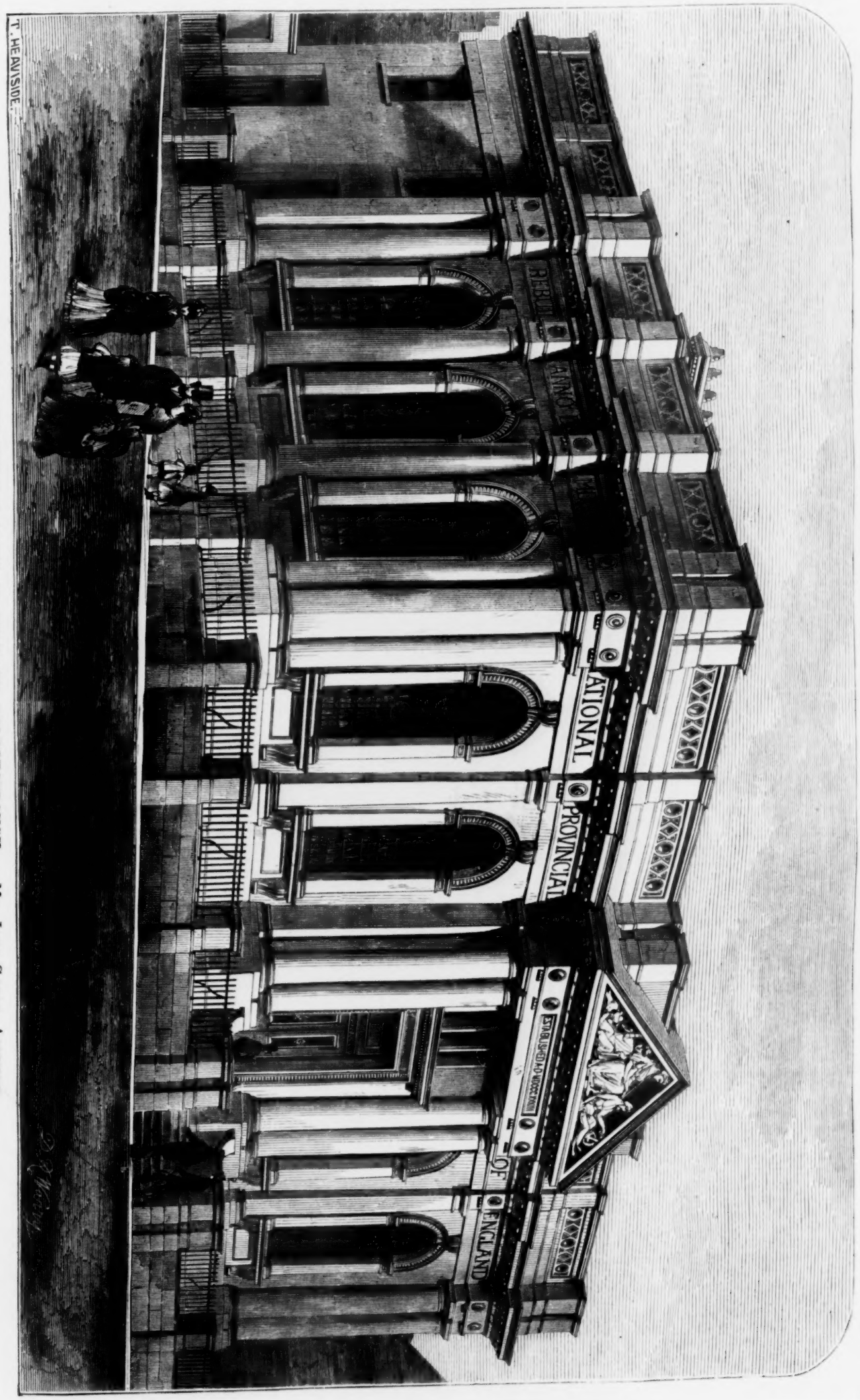
There are many fine brasses, and a splendid late Gothic monument to the Nassau family, which has been most carefully restored by Mr. Cuypers.

We have previously spoken of the disgraceful way in which this church is kept, and of its present neglected condition.

NATIONAL PROVINCIAL BANK OF ENGLAND, MIDDLESBROUGH.

Our view represents the premises recently finished (upon the former site) for the above important branch of the National Provincial Bank of England, having the principal entrance front to Cleveland-street, while the flank elevations are towards Gosford and Garbut streets respectively.

The exterior is faced with Stainton stone on the three fronts, enclosed with stone piers and an iron palisade. The pediment over the entrance doorway is filled with sculpture,—a female figure holding a shield, representing Middlesbrough, with the badges of the town, and motto, "Erimus," thereon. On either side respectively are figures of a miner, with pick and Davy lamp, and an iron-worker, with hammer, and wheels, these being indicative of the vast mineral wealth and employment in the district. The banking-room is about 66 ft. long, and 30 ft. wide, affording an ultimate accommodation for more than forty clerks, and is approached from the entrance-lobby by glazed double swing



NATIONAL PROVINCIAL BANK OF ENGLAND, MIDDLESBROUGH.—Mr. JOHN GIBSON, ARCHITECT.

doors. The manager is so situated as to be able to see over the entire room. There are also a waiting-room, manager's, and consulting room adjoining.

The principal strong-room and treasury are near the centre of the building, and adjoining to the strong-room for books in use; while underneath are spacious book and plate rooms, which are fitted up in a most secure manner with metal shelving and fireproof materials. The treasury has an iron room inside its fireproof vault, and is fitted up with every requisite against fire and burglars. Above these are the resident's apartments, whilst over and under the manager's room are those of the messenger.

The banking-room is lighted by eleven large windows, glazed with embossed plate-glass, in single squares, to the transome, the lunettes above opening for summer ventilation. These windows are protected externally by ornamental wrought-iron grilles.

The artificial lighting is by three sun-burners, surrounded by ornamental pierced zinc pendants, which effect the extraction of the vitiated air. The warming is by hot water from the basement story, from which the fresh air is emitted through specially provided channels. The fittings are of Honduras and Spanish mahogany, and the public space is paved with ornamental tiles.

Below the banking-room, besides the accommodation already mentioned, are the clerks' luncheon-room, lavatories, and so on.

The building was contracted for by Messrs. Potter & Wilson; the sculpture in the pediment by Messrs. Mabey; and the fittings were done by Messrs. Punch, Brothers.

The whole of the works were executed from the designs and under the direction of Mr. John Gibson, of Westminster. Mr. Glover acted as clerk of the works.

SOME OF THE SANITARY ASPECTS OF HOUSE CONSTRUCTION.*

THE architect is an artist, in that he has to beautify the structures which he erects; he is an engineer, in that he has to consider the strength and qualities of the materials to be used, and to apply those materials according to definite rules; he is a sanitarian, in that, in the construction of domestic buildings, he has to consider the conditions affecting health,—and the conditions affecting health are as much the subject of accurate rules as those which regulate the strength or beauty of a structure.

My remarks on this occasion will be limited to that portion of the architect's functions which relate to what may be termed healthy construction. Most of the facts and conditions are well known to the members of this Institute, but it seems advisable at the present time, when Parliament is directing its attention to sanitary measures, of which the construction of healthy dwellings forms an important branch, to lay the subject before your Institute in a connected form, with the object of showing the considerations which regulate the construction of human dwellings in reference to the health of the occupants, rather than to their architectural features. Moreover, a large number of houses are built by speculative builders without reference to architects, and, in these, considerations of health are little thought of.

The conditions necessary to secure the health of the inmates of a building should be present to the mind of the architect in the formation of his original design, as much as the strength and qualities of the materials with which he has to build; and upon these conditions should be engrafted those of comfort, convenience, and beauty. Palladio somewhere says that architecture, being grounded upon rules taken from the imitation of nature, admits of nothing that is contrary or foreign to that order which nature has prescribed to all things. This remark is peculiarly applicable to healthy house construction; for nature prescribes that stagnation breeds putrefaction, and that health depends on the absence of stagnation; in other words, air must be kept in motion, and water must not stagnate.

The requirements for health may be classed generally under the heads of:—

1. The purity and cleanliness of air.
2. An equable temperament.
3. Sufficiency of daylight.
4. Purity of water.

* From a Paper by Captain Douglas Galton, C.B., Director of Her Majesty's Public Works and Buildings, read at the Royal Institute of British Architects, as already mentioned.

The last consideration I will leave untouched on the present occasion, as it depends rather upon considerations outside the house, than upon the constructional arrangements.

Sufficiency of light is a material element of health; sunshine acts as a purifier of the air. In uninhabited rooms when the shutters are closed there will be found a close musty smell. This smell will be removed by the admission of sunshine, and thus daylight and sunshine assist in obtaining purity of air, which is the cardinal point in the construction of a healthy house.

The other two conditions fall naturally under the four chief heads of, first, *The site*, which should be dry, and not malarious; secondly, *The general arrangements* of the building, which should prevent stagnation of the air, and provide for the speedy removal of refuse; thirdly, *The materials*, which should insure dryness of foundations, walls, and roof, and be retentive of warmth, so as to prevent rapid changes of temperature; and fourthly, *The ventilation*, which should carry off the emanations constantly given off in respiration, &c. At first sight, these propositions appear so obvious as to render it unnecessary to enforce them by an essay. It may be urged, for instance, that no person who has studied the subject would build a house in a wet situation, where the purity of the air would be injured by moisture; that no person would select materials which would permit the wet to penetrate the walls; that the ventilation would be contrived so as effectually to prevent the smell of cooking from pervading the house. Yet how numerous are the houses in which every one of these obvious rules are transgressed!

A further condition of health is the maintenance of *perfect cleanliness* within the dwelling. This, no doubt, properly belongs to the occupiers of the house, but the architect is concerned in it to this extent—that cleanliness is promoted by abundance of light, and by the absence of dark corners. A dark house is an unhealthy house, an ill-aired house, and a dirty house.

Site.—It having been assumed as an axiom that no stagnant water should be allowed in the vicinity of any building site, either above or below the soil, it follows that surface drainage should be provided round all building sites. Houses should never be placed against the side or foot of a slope. Such a position is a fertile cause of fever, and is especially to be avoided when a bed of clay crops out near the foot of the slope. Houses should not be built on or near accumulations of refuse, as so frequently happens in the case of houses built in and near London.

In connexion with these considerations, houses may be classed under four heads or divisions:—

(*a.*) Large houses in their own grounds.
(*b.*) Houses of a similar class in towns where the influence of elevation, position, and external ventilation cannot be depended on.
(*c.*) Cottages in the open country.
(*d.*) Artizans' dwellings in towns.

The first division, viz., large houses in their own grounds in the country, may depend for pure air upon their elevation, position, and exposure; and the owner who has control of the land around can take all necessary measures to secure purity of the surrounding air. In selecting sites for barracks, the general suitableness of the place is certified to by the commanding officer of the district; the capabilities for water supply and drainage, by the engineer officer; and the healthiness of the locality and exposure, by the medical officers. In civil life it is generally the architect who decides all these questions.

In the case of the other three classes enumerated above, viz., houses in towns, and cottages in the country, it is difficult for any member of a community to separate his interests in the matter of health from that of his neighbours. The air may be contaminated by the action of persons over whom the owner of a house can have no control. The health of the community is thus dependent upon a proper supervision being maintained over the proceedings of the several members constituting it. This control, to be effective, must be vested, to a great extent, in persons professing architectural knowledge; and it is almost a certainty that before long Parliament will have recognised the necessity of placing upon qualified surveyors the duty of seeing that sanitary requirements, including the internal arrangements, the use of proper materials, and the drainage, are adequately provided in all new houses and cottages over the country. There is at the present time a supervision established over certain matters of construction, in the case of houses in some of our principal towns, but in very few cases are these requirements connected with the health of the occupants.

General Arrangements.—I have already shown that an abundance of light and direct sunshine are necessary for maintaining purity in the air. In hot weather the inner temperature of the house should not be raised by the heat of the sun passing through the roof or walls. The purity of the air in hot weather is generally maintained by open windows and open doors; but to insure this, it is necessary to design the house so that a free current of air may be passed through all parts of it. Hence back-to-back dwellings are not advisable. In towns there should be at the back of every house a clear air-space from the level of the lowest part of the basement along the whole width of the house, between it and the next building, and the doors and windows should be so arranged that, when they are all opened, they allow a current to pass through the rooms, and do not leave any portion of the air in a stagnant condition. In cold weather, on the other hand, the air of the house is required to be maintained at a higher temperature than the outside air. The heat generated in the house should not pass away through the roof and walls. Arrangements for maintaining purity of air are chiefly required for cold or damp seasons. The upward movement of air, warmer than that of the outside air, will draw up air from the basement: consequently the purity of the air of a house in cold weather will depend on the purity of the air in the basement, unless the basement is entirely cut off by solid arching from the house. The air of the basement, if it be below the level of the ground, will be rendered impure by fumes from the kitchen (if in the basement) and the cellars, and it will be derived partly from the adjacent soil. This air is generally impure.

The deleterious character of the air in the soil is chiefly due to the large proportion of carbonic acid which it contains. Dr. Pettenkofer's experiments show that at a few feet below the surface, the proportion of carbonic acid in the air is greater than that in the worst ventilated dwellings, and that the proportion of carbonic acid in the air taken from the soil is twice as large as that found in water collected from the same place. He showed that the quantity of carbonic acid at a depth of 15 ft. from the surface was greater than that found at 5 ft. from the surface during the whole year, except during June and July, when the proportion of carbonic acid was greatest at the higher level.

But there are other causes of impurity in the air which permeates the subsoil. In inhabited districts the organic matter left to putrefy in or on the soil injuriously affects both the air and water in the soil. In towns the emanations from the gas-pipes are a serious source of impurity to the air in the soil; so, also is the leakage from sewers. From both these causes the air in the subsoil is eminently polluted. Consequently, the purity of the air in the basement will depend partly upon the arrangements in the basement itself, and partly upon the purity of the air in the subsoil under and around the house, unless the basement has been entirely cut off from the surrounding ground by a sufficiently thick and continuous bed of concrete or a layer of asphalte laid over the whole surface covered by the house, and by sufficient areas carried below the level of the basement, cutting it off by an open-air space from the adjacent soil.

The floor of the basement, whether it be of wood, of stone, or of tile, should be from 1 ft. to 18 in. above the level of the surface of the area or ground surrounding it, and it should have a space under it for the circulation of air, and a damp course, either of asphalte, slate, glazed pottery, or other impervious material, should be laid below the level of the floor. By such means only can the floor of the basement be maintained in a dry condition.

As regards drainage, water will always be found to be the most convenient carrier of fœcal refuse. The dry earth system is convenient in some cases, and in cottages in the country districts water-closets would be expensive and inapplicable. All drainage arrangements, as a rule, should be against the outside walls of the house; but where it is absolutely necessary to carry a drain under a house, special arrangements should be made for access to and inspection of the drain-pipes, which should be water-tight in themselves, and they should not be buried. No cesspit should be allowed in or near any house. In large country houses it is possible to utilise the sewage for agricultural or horticultural purposes. In cottages in the

country sinks and washhouses should be outside the dwelling-house wall; the privies, or dry-earth closets, should be in out-houses separated by an air space from the house. If a cesspit cannot be dispensed with it should be at least 20 ft. or 30 ft. from the house, it should be made watertight, be ventilated, and be small to compel frequent emptying. In towns cesspits should never be permitted. If sewerage is not provided the midden refuse should be removed daily. Ashpits and receptacles for stable manure should never be below the surface of the ground. They should be paved and drained, and they should be small to compel frequent removal of their contents. Between any cesspit or any main sewer and the house, there should be a trap in the drain to cut off communication between the house and the main sewer or cesspit, and there should be an air-pipe carried up from the drain between the trap and the house to above the roof level to ventilate the drain. There should also be a ventilation from the cesspit, or in the main sewer, so as to render their ventilation independent of that in the house drain. Further, all down-pipes of house-drains should be carried up to above the roof, and left open at the top, and be carried down into a trap at the bottom. Waste-pipes from cisterns or sinks should not be carried into a down-pipe connected with the drain, but empty into a trapped grating so as to leave an air space between the waste-pipe and the trap; and so prevent the possibility of the waste-pipe acting as a conductor of sewer gas into the house. Water-cisterns always give off moisture; it is, therefore, unadvisable to place them in or near the occupied part of a house; but all cisterns and water-pipes should be so placed as to render their freezing impossible under any ordinary circumstances, because where the safeguards against sewer gases mainly depend upon the security of water-traps, any interruption to the flow of water is a source of danger. Water-pipes laid underground in the open air will not be safe from freezing at a less depth than from 20 in. to 30 in.

Plans for houses must necessarily vary with the wants of individuals; it is, therefore, only possible to lay down some few general principles which should be observed in the design. Amongst these, perhaps the most important for living rooms are those concerning windows, in the arrangement of which sanitary principles are frequently sacrificed to the design of the façade of a building. The model selected is frequently that of an Italian house; but in Italy windows are few and deeply recessed to keep out the heat and the brilliancy of the sun, whilst here the clouded sky makes an abundance of light necessary. For sanitary purposes the windows should be carried as near the ceiling as possible, and the lower the room the greater the necessity to observe this rule in order to freshen the air. Moreover, it is an element of cheerfulness in a room for the sills of the windows to be brought down near to the floor.

The proportion of window surface to the cubic contents of the room is of great importance, but it must to some extent depend on the aspect; instances could be pointed out of houses where architects have given to rooms of the same cubic contents, of the same form, the same aspect, and to be used for similar purposes, a window area twice as much in one room as in another to suit the façade.

In this climate adequate light will not be secured with less than one square foot of window surface to about 100 to 125 cubic feet of the contents of the room. This should be a minimum allowance, and assumes that the windows in all cases are of clear glass, but greater cheerfulness will be secured by more light. The effect of different qualities of glass on the diminution of light is shown by the following results of recent experiments:—

Polished British plate glass, ¼ in. thick, intercepted 13 per cent. of the light; 36 oz. sheet glass, 22 per cent.; cast plate ditto, ¼ in. thick, 30 per cent.; rolled ditto, four corrugations in an inch, 53 per cent.

The most convenient form of window for ventilation in this country is the sash window opening top and bottom. This mode of construction enables a current to be maintained, fresh air passing in below, whilst the vitiated air of the room passes out at the top. It is an absolute necessity for a healthy room that the window should open at the top, and it is most extraordinary in how many houses, even of the better class, windows are still found with fixed upper sashes.

MRS. BOWES'S MANSION AND MUSEUM, BARNARD CASTLE.

THE placing of the first roofing timbers at Mrs. Bowes's remarkable Mansion, of which we gave a view and plans in our volume for 1871, pp. 28 and 29, has been celebrated by a dinner to the workmen, more than a hundred in number. The dinner was held at the Goliah's Head Inn.

The Mansion is situated at the east side of the town, adjoining the Westwick-road. The walls have now reached such an elevation as to make the edifice a conspicuous object in the landscape from various points of view at several miles' distance from the town. The style of the building is that of the French Renaissance. The south or principal front is no less than 300 ft. in length, and the central dome will be carried to the height of 150 ft.; the rest of the front will have an elevation of 85 ft. East and west are wings, the length of each being 130 ft., the front being set back 38 ft. within these wings. Under the basement are twelve cellars, each 45 ft. by 15 ft., the walls and arches being of masonry. On the basement-floor there are seven rooms, exclusive of the principal staircase and entrance-hall. The entrance-hall is 42 ft. square by 31 ft. high, the walls being of polished freestone. The main doorway is 24 ft. 6 in. high, by 12 ft. 6 in. wide. The height of the principal staircase is 56 ft., the width 32 ft. The steps are fifty-four in number, of red Aberdeen granite, hanging out of the wall 8 ft. The landings are of stone from Craigleith quarries, Edinburgh, most of which are 11 ft. by 10 ft., and 6½ in. thick. Twelve polished red and grey granite column support and or nament portions of the staircase.

On the first floor there are seven rooms, one of which is 42 ft. square and 25 ft. high. On the second floor there are eight rooms, one of these also being 42 ft. square by 25 ft. high. The number of rooms in the third or attic story is fifty, with dormer and other lights more than 100 in number. In the central dome is an observatory.

The number of lights on the basement-floor is sixty-four; on the first floor, sixty-eight; on the second floor, seventy. The three picture-galleries in the north front are, together, 200 ft. long, by 45 ft. high; they are lighted from the roof by means of glass fitted in iron; each light is 41 ft. 6 in., by 20 ft., with a rise of 15 ft. The sculpture galleries are of the same dimensions as the picture galleries. The main walls of the building are 3 ft. thick, of ashlar; the dividing walls are of the same thickness; the solids to the angles are 8 ft. thick. In each wing there is a staircase, composed severally of 102 steps of Craigleith stone. The building contains two apartments each of which has twelve windows. The cantilevers, corbels, semicircular and pedimented windows, are to be elaborately and richly carved. Some of the beams of timber used in the floorings are 49 ft. long by 14 in. square. The beams for the floor of the picture-galleries are 48 ft. by 18 ft., by 14 in.; they are strengthened with iron flitches ¾ in. thick.

Adjoining the mansion will be a chapel, ornamental water, fountains, gardens, shrubberies, &c. From the summit of the building there are extensive and picturesque prospects. The building has been in progress for about four years, and is two-thirds completed. We understand that the work would have gone on with greater rapidity had it not been for the delay in procuring stone of the requisite dimensions for the numerous massive columns and entablatures. The architect of this great edifice is Mr. J. E. Watson, of Newcastle-upon-Tyne; the contractor, Mr. Joseph Kyle, of Newcastle and Barnard Castle.

Mr. Watson, at the dinner, said, in regard to Mrs. Bowes, that he had many times been professionally engaged in works of considerable magnitude in different parts of the country,—in England, Ireland, and Scotland,—but he had never, in the whole course of his experience, met with a lady like Mrs. Bowes; and when he took into account, the good and excellent ideas of buildings which that lady possessed, he declared that he never met her equal. They must know that she not only understood plans and elevations, but she thoroughly understood details, and it was under a sense of obligation that he remarked that she had given him many a practical and useful hint, and had helped, to no inconsiderable extent, the progress of the work.

THE COLOSSEUM AND THE ENGLISH STAGE.

SINCE the appearance of the letters as to the appropriation of the Colosseum, three correspondents have urged the use that might be made of it as a National Theatre, conducted on principles advocated in this journal. One of them writes thus:—Some time ago it was suggested in the *Builder* that a school of Dramatic Art would be of great advantage to the English stage. Here, then, is the school-house, with its theatre, &c., ready to hand. Mr. Godwin, who originated the movement, Mr. Planché and Mr. Tom Taylor, who followed suite, and Mr. George Rose, Mr. Charles Reade, Sir Duffus Hardy, Sir Coutts Lindsay, Mr. Wigan, Dr. Doran, Mr. Alfred Thompson, Mr. Hare, Mr. Bancroft, and others, who, with the first-named three gentlemen, met several times in committee to see what could be done to forward the scheme, have only to speak, to announce that a subscription-list is open, and the thing would be done. The Colosseum would bloom again in restoration if this suggestion were carried out, and henceforth be not only a land- but an art-*mark*, in this great city.

CAN ART BE TAUGHT?

THAT is the question? The question which has to be solved before we can sit in judgment on the means of instruction provided by the Royal Academy and South Kensington, or pronounce the organisation of their schools defective and their teaching inefficient. I myself believe that art cannot be taught; that it can be taught, has been, and still continues to be, one of the great fallacies of the age. Hence, at a great expense, the nation has established the Art Department, and I think few persons will dissent from the verdict that Mr. Cole has left nothing undone that possibly could be done to make the Art Schools at South Kensington perfect in their arrangements and appliances. The machinery is complete. If the results, therefore, have not been satisfactory, it is because the public have expected that South Kensington could do what is impossible,—breathe into unattempered *dust* the breath of genius.

A favourite motto of the Royal Academy is "Labor et Ingenium." The Art School is open to the "Labor," both with and without the "Ingenium." It is, however, only the "Labor" in conjunction with the "Ingenium" that can turn the best of schools to account.

We have long been floundering, too, in the error that art is a great teacher, whereas it has always been the outcome and index of the intellectual characteristics of a nation. It shows what has been taught. That kind of education which will make a nation truly great, will also make it correct in taste.

Let me endeavour to place this last proposition in its true light. Imagine man as first created, perfect in mental constitution, perfect in body, perfect in sensibility. For a being so constituted possessing the "ingenium," the perfect mechanism of an art-school is adapted. That art which is not the offspring of and adapted to healthy sensibility, will exhibit morbid characteristics, and is not worth having. And neither the schools of the Royal Academy nor South Kensington will ever completely answer public expectations till the human intellect, physique, and senses be developed nearer to the standard of perfection. If the general opinion should be that this cannot be effected, either shut up your art-schools, or leave them open as now to the few whose exceptional and more perfect organisation can fully utilise them. If, on the other hand, organisation can be raised, improved, let us leave the art-school alone for a time, and direct all our energies to what should be the prior and more important work of general culture, resting assured that in due season the good husbandry will produce, among other grand results of the harvest, fine art. When that season comes, the art-schools of South Kensington will be appraised at their proper value. Let us endeavour to bring art out of men, instead of vainly endeavouring to pour it *into* vessels marred in the hands of the potter.

W. CAVE THOMAS.

THE WORD "WYK."

THERE was a very excellent system of teaching the etymology of English words in vogue, many years since, at University College School, and I fancy that I was then taught that "wick," "wyk," "wyke," were transmutations of the Latin, *vicus*, a village. T.

EXHIBITION OF THE ROYAL SCOTTISH ACADEMY.

THE forty-eighth exhibition of the Royal Scottish Academy, comprising 1,043 works, is in many respects a satisfactory one, all the more so that it owes nothing to extraneous aid, but consists, with one or two trifling exceptions, of the productions of native artists. There are few works exhibited which can be considered great, either as regards subject or invention; there is steady progress, however, shown in the manner of treatment and power of execution; but a lack of seriousness and depth of feeling. There is much to delight the eye, but little to touch the heart or exercise the mind,—we look for the embodiment of ideas as well as technical excellence.

The mere choice of a great subject does not show that the artist is great; he is only so when he embodies and gives expression to the higher emotions; he may, if he is gifted with the faculty, throw into an every-day occurrence an amount of feeling which will raise it above common-place and vulgar associations; but the subject must be interesting, and worthy of being dwelt upon; it should not only impress the beholder by its beauty of colour and execution, but by the effect it has upon his imagination and nobler sentiments.

The most popular of Scottish artists is Sir Noel Paton. His subjects are not trite and commonplace, but partake largely of the imaginative element. They are pleasant to look upon, the product of an amiable and highly refined nature,—the refinement of the boudoir rather than that of the saloon; redolent of sweet odours and softest music. No. 163, "Oskold and the Ellé Maids," is a characteristic example. A knight on horseback is beset by visionary figures floating in a phosphorescent light, who "proffer him all manner of solace and pleasure." The "fair demoiselles" are the best part of the picture; the knight is a "carpet knight"; his "stout horse," weary from a long day's journey,—a lady's palfrey ambling gracefully along. A hard metallic glitter pervades the whole, which is far from pleasing. Beside this work is one by Hugh Cameron (173), "Age and Infancy," and no greater contrast could be [found than there is between these two works. The poetry here is that of humble life, unaffected, simple, and refined, without being weak in execution, and it is delicious in colour.

The hand of the president, Sir George Harvey, has not lost its cunning. No. 188, "Port Sonnachan, Loch Awe," is equal to anything he has hitherto done in landscape art, and that is saying enough.

No. 210, W. Fettes Douglas, "The Midnight Despatch: Cromwell receiving Notice of 'The Start;' the Invasion of England by the Scots previously to the Battle of Worcester," is one of the works that make one sigh. The scene is a dark night, with the stars twinkling overhead. The messenger who brings the despatch is wonderfully like a night-policeman as he stands with his lantern giving light to Old Noll to read. Very curious is the reflection of the light on the eye of the said messenger; it looks as if a hole had been bored through his caput, and one of the stars was seen through the aperture. Melancholy it is to behold the bloated character intended to represent the great Protector, and pity it is to see the sloppy manner in which the paint is laid on. Mr. Douglas has done, and can do, better than this.

A ray of sunshine gladdens our eyes as we catch sight of "The Clyde" (244). It is one of the most successful works of James Cassie, whose eagle-eye does not succumb to the meridian sun. Faed's "When the Day is done" (261) next attracts attention: it has already been exhibited and commented upon, and need not therefore detain us. William Mactaggart presents us to three graceful damsels "At the Fair" (342), who are engaged in contemplating a photograph of one of their sweet selves. The work is elegant in composition and harmonious in colour.

No. 346 "The Holy Well, Lough Atalia, Galway," is a well-chosen subject by W. F. Vallance, and it is well delineated too. It represents one of the phases of superstition—relics of water-worship—which linger in the remote parts of the United Kingdom. The different observances of peregrinating round the well, picking up pebbles and dropping them into the water, &c., culminating in the final act of devotion, are all graphically rendered.

Of lofty aim, conjoined with excellence of representation, there is nothing in the exhibition equal to No. 361, "A Conventicle Preacher arrested and brought before a Court of Justice," by Robert Herdman. No period of its history has made a deeper impression upon the people of Scotland than that from which the incident is taken, and the times abounded with such. The stern, unflinching enthusiasm of the preacher; the cruel, cynical expression of the judge; the contemptuous look and attitude of the cavalier; and the cool indifference of the myrmidons of the law, are all rendered with truthfulness and force, and yet without exaggeration.

No. 439, "The Duet," is the largest work yet produced by R. P. Bell. The duet is being performed by a beau and a belle, elegantly attired in the Queen Anne style. They are a handsome couple, well matched, and the artist has done them justice.

Nos. 459 and 460 are two bits of nature, freshly and deftly painted by Alexander Fraser. In passing, we remark that Walter Paton is more reticent than usual in the use of purples. A little more force and vigour are still wanting in his works.

J. B. Macdonald has given up figure subjects and taken to landscape. No. 12, "Strathyre," is a large and powerfully-painted view of a Highland strath. It will bear comparison with the works of Graham and Smart, which have attracted so much attention in Burlington House.

It is not often that we see a portrait of a gentleman in modern costume which we would desire to possess as a work of art, pure and simple; but such is No. 41, by G. Paul Chalmers. Portrait-painting seems to be his forte, and to that he appears now to devote his attention.

No. 59, "Medea in the Island of Circe," is a subject which enables William B. Hole to contrast a graceful classical figure (hardly original) and the "many beasts" with which she is surrounded.

Architectural drawings hereafter.

NEW STONE-DRESSING MACHINE.

IN August, 1869, an American stone-dressing machine, Holms's, was exhibited at work at the west end of the Victoria Embankment, and was noticed in the *Builder* at the time. The action of the cutting-tool in that machine was eccentric, but it was really a cutter. Other machines for cutting and dressing stonework operate by continuous pressure. A new machine, on a perfectly distinct principle, is inviting the attention of builders and contractors. It is the invention of Mr. G. Stacy, of the State of New York, and has been exhibited by Messrs. Lawrence Brothers, of Holborn-circus.

The machine is double-acting, the travelling-table and the parts moving in either direction as may be most convenient. The machine exhibited is the first of its kind that has been made, and requires to be perfected in some of its details. It was constructed by Messrs. Hoe & Co., of New York, under the direction of the inventor; it is quite sufficient to illustrate the principle of the invention, the essence of which lies in the substitution of a mechanical contrivance for the human hand, for holding, applying, and directing the working tool. In this machine the chisels are made to imitate the action of stone-dressers' hand-tools, that are operated on by percussion rather than pressure.

In the machine the stone to be dressed is laid upon a travelling-table that is moved by a rack and pinion; by means of a rachet-wheel and catch, the table may be moved by stops of from ¼ in. to ½ in., or, by disengagement of the detent-catch, a continuous movement may be given. The working parts are raised and lowered by an arrangement of bevel-gear. These parts consist of two horizontal rotating shafts, that are furnished with series of spirally-arranged hinged hammers. The hammer-heads have slots into which steel chisels are fitted, and fixed by semicircular wedges. When the machine is in action these chisels strike the part of the surface of the stone, with which they are brought into contact in precisely the same way as a surface is attacked by the stone-cutter's chisel and mallet. Only one chisel strikes at the same instant, and the machine may be so adjusted that a chisel may be made to pass over the same portion of the surface from one to six times before the table moves on. The *débris* in working is precisely the same as is made by the stone-cutter, stone-dust and thin flat chips.

There are two rotating shafts fitted with hinged hammers and chisels; the one that first comes into action does the rough hewing, the other finishes the work. The stones operated upon in the exhibition of the machine have been Yorkshire flagging, Portland and Bramley Fall. We have seen it at work upon the two sorts last named. On Saturday last it was put to work upon a block of Bramley Fall stone 7 ft. long and 21 in. square. The supply of power, abstracted from the ordinary work that the engine was doing, was irregular and defective, although this machine requires very light power considering the work it can turn out. The first shaft took off about ¾ in., which was a severe strain, and enough, we would have thought, to have stripped off the whole of the chisels to the roots, but every one of them passed through the ordeal cool and unharmed. The speed, after both shafts with their tools came into operation, was 9 in. lineal per minute of the 21 in. wide surface. With command of the power from a 3-h.p. engine, the machine is equal to from 15 in. to 18 in. lineal per minute of a piece of freestone 18 in. wide. The chisels are arranged on the shafts so as to embrace every portion of the surface of the stone under treatment. When they come into contact the hammer-head is solid upon its rest, and recoils as soon as the stroke has been delivered, carrying the chisel over the unhewn portion. Each rotating shaft is fitted with eighteen chisels, and at ordinary speed the shafts make 200 revolutions per minute. Taking the speed at 150 per minute gives the action of 2,700 chisels upon the stone in that time.

The finished work is produced, as may be seen, at very low cost. From the mode of working, one tool only strikes at a time. The power required is very light, and the tear and wear are said to be inconsiderable.

NEW MUNICIPAL BUILDINGS FOR BIRMINGHAM.

AT the meeting of the Birmingham Town Council, the Estates and Buildings Committee recommended the acceptance of a tender amounting to 83,220*l.* for the erection of a suite of new municipal buildings. The Council approved of the report. The proposed buildings, which will now be proceeded with on the site adjoining the Town-hall, will include spacious council-chambers and offices for all the borough officials. The Assize Courts will be erected adjoining the municipal buildings as soon as Birmingham is made an assize town. Mr. Thomason, of Birmingham, is the architect.

THE PROPOSED AQUARIUM FOR LIVERPOOL.

MR. BEALE has obtained from Mr. C. H. Driver, architect, plans of a building such as he desired. A suitable plot of land has been conditionally secured in Myrtle-street, and on this it is proposed to erect the new institution.

The building which it is proposed to erect will comprise in itself an aquarium, a concert-hall, a conservatory, a restaurant, and a photographic saloon, thus embracing, in one building, the most popular portions of the Sydenham Palace. These are to be so arranged that the whole can at the same time be thrown into one, or, as occasion may require, they can be kept separate and distinct. The principal entrance to the building will be in Myrtle-street, and will be in the centre of the block of buildings, opening into a large porch and vestibule, giving access to the aquarium and concert-hall on the right and left. The aquarium, which it is proposed to place at the west side of the block, will be entered from the main entrance vestibule by a doorway opening directly into the aquarium. The aquarium itself will be of ample size, containing various tanks varying from 6 ft. to 70 ft. in length, and containing in the aggregate nearly 100,000 gallons of sea-water. This water will not be required to be pumped into the tanks; for when once the tanks are filled there will be no occasion to renew the supply. The tanks, it is intended, shall be so constructed as to adapt them to containing larger specimens of animals than are usually to be seen in the present aquaria, and which may from time to time be brought as curious specimens to such a large seaport as Liverpool. In addition to this considerable provision will be made for a large number of store tanks, experience having demonstrated that these are most useful and necessary for the purpose of reserve. They will also answer the purpose of hospitals

for sickly specimens, as these may present themselves, and may also be utilised for scientific observations. It is also contemplated to provide table-tanks, for small specimens needing to be carefully got at for feeding, and which cannot so well be inspected in the larger tanks. The central table-tank in the large hall is intended to have rockwork, ferns, foundation, &c., with a view to making it a pleasing object of sight, besides its being a useful adjunct to the aquarium proper. The reservoir engine and boiler rooms will be situated in the basement, under the aquarium, which will also be devoted to work-rooms, stores, &c. The seawater reservoir will be constructed to contain 400,000 gallons of seawater, or, as is computed by most scientific authorities to be desirable, four times the quantity contained in the tanks. The architecture of the aquarium it is proposed to decorate with a moderate amount of judiciously-applied colour. The columns, arches, &c., are to be in cast iron, of an ornamental design, and the floor will be inlaid with encaustic tiles. The concert-hall, the entrance to which it is proposed shall be from the main entrance-hall and vestibule, will be on the same line, in the principal avenue of the aquarium. By this arrangement an uninterrupted view from the front of the orchestra in the concert-hall to a rockery to be placed in the aquarium will be gained,—a length of 225 ft. This hall will be a *fac simile* of the St. James's Hall, London.

THE TEMPLE OF DIANA, EPHESUS.

MR. J. T. WOOD writes,—The ground has now been cleared and thoroughly explored on all sides for about 30 ft. beyond the lowest step of the platform on which the temple was raised. A considerable length of the step itself was found in position. I have, therefore, ascertained the exact length of the platform; I have also ascertained the dimensions of the temple itself with greater accuracy, having found in the part recently opened up the remains of piers connected with the foundations of the columns of the peristyle.

The temple is found to measure 163 ft. 9½ in. by 342 ft. 6½ in.; the platform on which it was raised 239 ft. 4½ in. by 418 ft. 1½ in., measured on the lowest step. The length here given nearly accords with that given by Pliny—viz., 425 Roman feet; the ascertained width exceeds Pliny's dimension of 220 ft., which dimension must have therefore lost something in transcript from the original.

An element of great beauty had almost escaped discovery—*i.e.*, the plentiful use of gold in the decoration of the temple. One fragment was fortunately found composed of two astragals, between which a narrow slip of lead was doubled in, in the fold of which was inserted a narrow strip of gold, which formed a fillet of gold between the astragals.

The beauty of the temple was, moreover, heightened by the use of brilliant colours, remains of which are found in numerous fragments, blue, red, and yellow being readily distinguished—blue for the background of enrichments and sculpture in relief, red and yellow for the parts requiring greater prominence.

A number of the columns are inscribed on their bases, showing that they were dedicated to Artemis by various persons or communities. The question whether the pronaos was fenced off from the peristyle has been decided by the discovery of some of the mortises for the iron standards.

COLUMBIA MARKET AND THE CORPORATION.

WE regret sincerely that the correctness of the opinion we expressed on the opening of Columbia Market as to the mistake that had been made, is more and more confirmed as time rolls on. The establishment which was some time ago handed over to the Corporation by the Baroness Burdett Coutts, with the view of its being converted into a fish-market, is destined to be a failure. At a meeting of the Corporation held last week a report was presented by the markets committee to the effect that although advertisements had been inserted in numbers of newspapers on the fishing coasts, and in the daily papers, stating that the corporation were ready to receive applications for the sale of various articles of food, they had not received a single answer, and that although the stands were offered at nominal rents no one applied for them. It was further explained that the cost of the proposed tramway between the market and the Great Eastern Railway would be 34,000*l.*, whereas the original estimate was only 10,000*l.*; and upon this an animated discussion took place, in the course of which the abandonment of the tramway, as well as the market itself, was suggested.

In answer to Mr. Isaacs, architect, Mr. Rudkin, the chairman of the Markets Committee, stated that the committee had not consulted their own architect prior to bringing up their report, estimating the cost of the tramways at 10,000*l.* It was on the estimate of Mr. James Hassard, the engineer employed by the Baroness, and Mr. Hassard, solicitor, that the scheme went through Parliament, and the committee took Mr. Hassard's advice.

Mr. Colls said the making of the market was impossible, and the sooner that fact was recognised the better.

Mr. Bontems, adverting to the construction of the tramway, said he would have been quite willing to lay out 10,000*l.*, while he was not willing to spend 34,000*l.* Therefore the court should consider whether the expenditure of 34,000*l.* would be likely to make the market more successful than at present. He proposed a resolution to the following effect, which was adopted:—"That the markets committee be requested to report the rates of carriage, both by water and rail, for the various kinds of fish sent to Billingsgate Market, and the estimated rates to Columbia Market, in the event of the tramway being made; and also to report the opinion of the committee as to the expediency of making the tramway."

It will, therefore, be seen that, although the Act for the construction of the tramway has been obtained with a view to develop and utilise the market, the chances of the works being carried out are at present rather doubtful.

GRINDING MONEY.

MESSRS. JACKSON & SHAW, contractors, were summoned at the Westminster Police Court by a carpenter, named Morgan, for 9d., one hour's money, allowed, as he alleged, by the rules of the trade, for grinding his tools on discharge. A number of witnesses were called, who deposed that in all the large firms in London—Myers, Holland & Hannen, &c.,—two hours were allowed for grinding, and one witness deposed that, having been in the service of the defendants at the new Foreign Offices and discharged, he was allowed two hours by the foreman, and paid. The rules for the guidance of the trade, passed and allowed at the last meeting in connexion with the strike, were produced, but they contained nothing about the grinding. Mr. Woolrych was of opinion that the claim had not been substantiated; it was a pity a more general practice did not prevail, and that the rule had not been printed. He dismissed the summons.

A NEW POLICE-STATION IN KENSINGTON.

THE handsome church of St. Mary Abbott, Kensington, has a new architectural neighbour in the shape of police-office buildings. On the north side of High-street, a building of this character has just been erected on the angular piece of ground at the rear of a tavern opposite to the churchyard, the north boundary wall of the new police buildings being immediately adjacent to the churchyard area. It is not surprising that when the building was first contemplated some objection was raised to a structure of that character being erected there, on the ground that it would mar the effect of the edifice adjoining; but we understand that, in order to meet such objections, it was decided that, in its architectural design and character, the building should present a more ornamental appearance than structures of this nature usually do, and be made to harmonise as far as possible with its ornamental Gothic neighbour. The main frontage of the building, which is Late Gothic in character, is to the east, and is seen to considerable advantage when viewed from the junction of Church-street with High-street. It is upwards of 40 ft. in height and 30 ft. in width, and, in addition to a basement, contains the ground-floor and story above, together with gables in which there are small dormers and an upper-floor. The materials used are red Fareham brick, interspersed with blue brick, Bath stone being freely introduced for dressings. At the south-east angle of the elevation there is a lofty covered archway, leading to the entrance into the building. The windows on the north side of the elevation are in three lights, with stone dressings. A string-course of stone is carried across the elevation at the head of the windows of each story, and at each angle there are stone quoins carried up to the top of the building. The elevation on the north side fronting the church resembles in its general features that already described, with the exception that it is not surmounted by gables. It is of a somewhat irregular projecting character, being semi-hexagonal in form in the centre, with stone quoins at each angle, uniform with the east frontage.

The basement of the building contains the officers' mess-room, washing-room, store-rooms, and the officers. On the east and west sides of the entrance are the officers' day-room and library, the inspector's office being at the front of the building on the north side, and the charge-room in the rear, communicating directly with the cells. The inspector's apartments are on the first floor, and the beds for single men are in the several rooms in the upper story. The ground in the rear of the building is limited in its area, but will nevertheless admit of being used as a parade-ground on a small scale.

Mr. Caiger, the metropolitan police surveyor, is the architect of the building; and Mr. M'Cullum, of Camberwell, the contractor.

"TICKHILL."

I WOULD suggest that Tickhill might be classed with Tichbourn, as a topographical name derived from the propinquity of water.

Tickhill is situated near the source of a tributary of the Trent, called variously Torne or Thorne, and old Don or Doon; indeed, it is the only considerable place in this unimportant river.

The root word "ick," "ich," or "itch," is a form of "ock," and very widely distributed; we have Ick-ford, Oxon; Ick-ham, Kent. There are Itchins in Gloucestershire, Hants, Sussex, and Warwickshire.

With the article it would be "T'ick," and I have no doubt, if we had the original settlement before us, we should see that T'ick-hill was a natural moated eminence, very suitable for defence. A. H.

PRE-HISTORIC REMAINS IN ISTRIA.

LONDON ANTHROPOLOGICAL SOCIETY.

AT the last meeting of this society, held at 37, Arundel-street, Strand, Dr. R. S. Charnock, F.S.A., president, in the chair, a paper was read by Capt. R. F. Barton, her Majesty's consul at Trieste, entitled, "Notes on the Castellieri of Istria." These were hill-forts, of which a perfect military disposition was effected, so that on all occasions two points were in sight always, for convenience of signalling. The experienced eye can always detect at a distance the traces of an earthen ring or ellipse, formed by levelling the summit and the gradual rise of the roads, or rather camps, which are, as a rule, comparatively free from trees and thickets. A nearer inspection shows a scatter of pottery, whose rude sandy paste contrasts sharply with the finished produce of the Roman kilns, and the more homogeneous materials of modern times. The contours of these castellieri are distinguished by a definite deposit of black ash from the surface soil of "red" Istria around them. As a rule, the castellieri occupied the summits of the detached conical hills and mounds, which appear to have been shaped and turned by glacial action. Some Istrian towns have been built upon the prehistoric sites. Viewed from below, they appear to be perched upon the summits of inaccessible stone walls. They can scarcely be called villages, but rather towns in miniature. The whole peninsula was at one time studded over with these villages, and fate has treated them with her usual caprice. They are in process of disappearance, being found useful for villages, and on the heights for the rude huts of the shepherd and the goatherd. Capt. Burton gave a minute description of fifteen castellieri in the territory of Albona. The Cunzi Hillock was the chief of these. It is about a mile long, disposed north-north-east to south-south-west. The crest of the cone has been evidently cut away in one or more places, leaving part of the original earth-

slope to form the parapet base. Upon this foundation were planted large blocks of lime-stone, sometimes of 2 cubic yards, in tolerably regular order, invariably without mortar, and never of cut or worked blocks, the *tout ensemble* forming a rough architecture, of the style known as Cyclopean. The inner thickness of the parapet was apparently filled with smaller stones, and the thickness varied from 18 ft. to 31 ft. The inner scarp was steep, and clear of rubbish. The *enceinte*, where probably were kept the cattle and goats belonging to the villagers, was mostly grass-grown. In another of the castellieri were found some interesting specimens of stone weapons, all belonging to the polished category vulgarly called "neolithic." None of the presumed older and ruder type have been found in Istria.

An interesting discussion took place on the paper, in which Dr. R. S. Charnock, Dr. Carter Blake, and Messrs. Leitner, Carmichael, and Lewis, took part.

BRADFORD CORPORATION MARKETS.

CONTINUING the development of the markets scheme, the corporation of Bradford has authorised the construction of the new Butchers' and Fish Market, in Rawson-place, at a cost of about 10,000*l.* for this portion of the scheme. The present covered Market Hall has only been completed upon about one-half its intended area, and will, when finished, have Godwin-street for its northern boundary. On the upper side of Godwin-street the new fish-market is to be located. The principal entrance will be from Godwin-street, and two side entrances are arranged from Rawson-place. Fronting these streets a belt of sixteen shops has been planned, which will have external frontage and approach, and open into the Market Hall. Internally, sixty-three shops and stalls have been arranged on the plans; so that in all about eighty new shops and stalls will eventually be provided. The building is of somewhat plainer character than the Kirkgate Market, but will correspond with it in style. Internally there will be an open-timbered roof instead of iron, as in the Kirkgate Markets, on account of the cost.

When completed, the Kirkgate Markets scheme will comprise an outer set of shops, offices, and club buildings, Market Tavern, and Trevelyan Hotel, having frontages to Kirkgate, Darley-street, and Godwin-street, and enclosing on three sides the spacious market-hall, which will be chiefly used for dry goods, and immediately adjoining will be the new fish and meat market. A new street, 45 ft. in width, will be formed from North Parade to Godwin-street.

The new St. James's Wholesale Markets are rapidly approaching completion, and will be served with railway facilities in direct communication with the Great Northern Railway, and ample accommodation for wholesale dealers in potatoes and fruit. These premises are on the ground adjoining the Corporation abattoirs, off Leeds-road.

These various works are in hand for the Fairs and Markets Committee of the Bradford Corporation, and are under the superintendence of the architects, Messrs. Lockwood & Mawson.

SURVEYORSHIPS.

AT the last meeting of the Chester City Council Alderman Littler moved the recommendation of the Corporate Estate and Improvement Committees, "that the assistant surveyor, Mr. Isaac M. Jones, be appointed surveyor to the council, in the place of the late Mr. Richard Davies, at the salary of 150*l.* per annum. The motion was carried unanimously. It was also agreed that Mr. Jones be appointed inspector under the Contagious Diseases (Animals) Act, 1869. A foreman of the works was to be appointed under the surveyor, at 1*l.* 15*s.* per week. The sub-committee thought it advisable to leave this appointment open so far as the nature of the duties were concerned.——At the last meeting of the Daresbury Highway Board, Mr. John Darbyshire, Stretton, was appointed as surveyor to the Board.

At the last meeting, the Council of Sheffield proceeded to the election of a borough surveyor. On the first voting, Mr. J. A. Bryson, deputy borough engineer, of Newcastle-upon-Tyne, had 25 votes; Mr. Coghlan, C.E., of Margate, 21; and Mr. Vawser, borough engineer, of Warrington, 5. Mr. Vawser was then struck out of the voting. On the second voting, Mr. Coghlan had 26 votes, and Mr. Bryson 25. The former was consequently elected. The salary is 500*l.* per annum. The loss of Mr. Coghlan seems to be regretted in Margate.

WHOLESALE ROBBERY.

WE have seen a copy of a scoundrelly trade paper addressed to builders in which the whole of the readable matter is stolen from the *Builder* without the slighest acknowledgment of the source. The same course appears to be pursued every week, other journals who honestly provide original matter being treated in a similar manner. We give the thieves notice that if this conduct be repeated we will see what the Court of Chancery can do with them.

HANOVER CHAPEL.

SIR,—It was distinctly stated at the Institute, by Mr. Cockerell, that the stonework had to be coated with oil. And I added that where so coated the stone had been remarkably preserved. I also stated that the towers had not been so coated, and had so seriously decayed that a large quantity of stone had to be cut out and renewed. This new stone was treated with Ransome's solution, which received it remarkably well. Thinking the old stone of towers which had not been coated with oil might be benefited by the solution, I ordered its application, but the solution which entered the new stone would not penetrate the old, and remained on the surface, although the old had been subjected to a very severe process of cleansing with the steam jet with a pressure of 56 lb. of wet steam.

That portion of the front which was originally coated with oil has not been treated with Ransome's solution at all. It has simply been cleaned without any abrasion of the weathered surface of the stone. ED. C. ROBINS.

ARCHITECTURAL WORKS FOR LONDON INTERNATIONAL EXHIBITION, 1874.

HER Majesty's Commissioners will feel greatly obliged for any information as to the present possessors of drawings and pictures by the following artists:—

J. Coney, who died in		1833.
J. S. Cotman	„	1842.
A. W. Pugin	„	1832.
F. Mackenzie	„	1842.

The subjects of works by these artists are for the most part architectural.

BUILDING WITH CONCRETE BLOCKS.

INSTITUTION OF CIVIL ENGINEERS.

THE paper read on the 10th inst. was "On the Construction of Harbour and Marine Works with Artificial Blocks of large size," by Mr. Bindon Blood Stoney, M.A.

The author described a method of submarine construction, with blocks of masonry or concrete exceeding in bulk anything hitherto attempted. The blocks were built in the open air on a quay or wharf, and after from two to three months' consolidation they were lifted by a powerful pair of shear-legs, erected on an iron barge or pontoon. When afloat, the blocks were conveyed to their destination in the foundations of a quay wall, breakwater, or similar structure, where each block occupied several feet in length of the permanent work, and reached from the bottom to a little above low-water level. The superstructure was afterwards built on the top of the blocks in the usual manner by tidal work. There was now being built in this manner an extension, nearly 43 ft. in height, of the North Wall Quay in the port of Dublin. Each of the blocks which composed the lower part of the wall was 27 ft. high, 21 ft. 4 in. wide at the base, 12 ft. long in the direction of the wall, and weighed 350 tons. The foundation for the blocks was excavated and levelled by means of a diving-bell, the chamber of which was 20 ft. square and 6½ ft. high. When the men were at work the bell rested on the bottom. A tube or funnel of plate iron, 3 ft. in diameter, rose from the centre of the roof of the bell to several feet above high-water level. An air-lock on the top of this funnel afforded a passage up or down, without the bell having to be lifted out of the water. The material excavated was cast into two large trays, suspended by chains from the roof of the bell; when these were filled, the bell was lifted a few feet off the bottom, and the bell-barge was drawn a short distance away from the line of the wall where the stuff was discharged, by tilting the trays, and the bell returned to its work again.

The method of making concrete and mortar, adopted by the author, differed in some respects from that in ordinary use. He preferred a rapid mixture of the ballast or sand with cement or lime, to the slow triturating process of the mortar-pan with edge-runners. The concrete mixer, devised by him, driven by a 3-h.p. engine, would turn out from 10 to 12 cubic yards per hour.

The author believed the application of the new system of gigantic blocks to the construction of breakwaters would, in many cases, be cheaper, more rapid, and more permanent, than the ordinary methods of construction.

SANITARY MATTERS.

Leeds.—The medical officer of health for Leeds (Dr. George Goldie) has issued to the Sanitary Committee his annual report as to the sanitary condition of the borough during last year, from which we give the following:—For the year ending December 31st, 1873, the death-rate was 27·2 per 1,000 of the population, being 0·8 less than the previous year. The number of deaths in one week ranged from 98 in the 28th week to 182 deaths in the 44th week, yielding relative rates, varying from 18·8 per 1,000 to 34·8 per 1,000 per annum. The fourth quarter was exceptionally the most fatal one in the year, during which the principal cause of the prevailing mortality was scarlatina and bronchitis. Among the sanitary works done was the closing of ninety-five cellar dwellings.

Alcester.—At the last meeting of the local Sanitary Committee, some cases of deadly overcrowding in Feckenham parish were brought under notice by Mr. Fosbroke, the medical officer of health. His report dealt more particularly with Astwood Bank, where there is an absence of any system of drainage, and the cesspools in most cases require covering, and are too near the back-doors of the houses; and the water supply, although in quantity sufficient, is derived, in many instances, from wells placed too near the cesspools. The report also commented upon the prevalence of scarlet fever in the place during the last six years, and recommended the adoption of some means for isolating cases in order to arrest the disease. Mr. Fosbroke was directed to make inquiries respecting the cost and other particulars of a movable hospital; and Mr. Gander was directed to make a plan of the present drainage of Astwood Bank, with a view to some complete system of drainage being carried out. The committee empowered the medical officer to order the ashpits of all new houses to be enclosed and covered over.

COMPENSATION CASES.

YOUNG *v.* THE LONDON SCHOOL BOARD.

THIS was a proceeding in the Sheriff's Court, Red Lion-square, to determine the value to be paid by the London School Board to Mr. George Adam Young, an architect, in respect of seven freehold houses, required for the formation of a new school under the compulsory powers of the Education Act, 1873, situate in Tower-street and Lumber-court, Seven Dials.

The jury went to take a personal view of the spot where the houses stood before they heard the evidence. The houses had been pulled down to erect a school, and Mr. Under-Sheriff Burchell took occasion in the course of the case to suggest that, where a jury was likely to be summoned to try the question, the property should not be interfered with until the compensation was settled.

The only evidence given was on the part of Mr. Young. The three surveyors on his behalf were Mr. Clark (of the firm of Farebrother, Clark, & Co.), Mr. Edwin Fox, and Mr. Shoppee. The claimant was not called. The houses were let out in weekly apartments, and in order to arrive at a value one-third was deducted for repairs, losses, &c., and the net value was calculated, and the sum brought out 6,480*l.*, to which was added 648*l.* as the customary 10 per cent. on a forced sale. The houses were built about 150 years ago, and let to poor but honest persons, as stated by the collector, and he added that sometimes not only had a bad tenant to be forgiven his rent, but to be paid for going away. Mr. Clark estimated the ground to be worth 1*s.* 6*d.* per foot per annum, which would nearly realise the value he had put upon the houses.

On the part of the School Board no evidence was given. It was denied that the property was of the value described, and evidence, it was alleged, which might have been given had not been produced.

Mr. Hawkins submitted that he had shown the net value to be 6,680*l.*, and, with the usual percentage under compulsory powers, the sum to which Mr. Young was entitled was 7,128*l.* He had, after conferring with his learned friend, not called Mr. Young.

Mr. Bidder, on the part of the School Board, invited the jury to arrive at a different conclusion from the state of evidence before them, and intimated that for such property let out in weekly tenements an inflated scale had been used to ascertain the proposed value. The property was not required for a public company to make profit, but to build a school, and the ratepayers would have to pay whatever value the jury assessed.

The jury retired, and on their return gave a verdict as to the value, &c., at 5,233*l.*, adding 1*s.* as damage for severance of the property.

ROUNDHAY PARK COMPETITION.

WE are requested to print the following protest, addressed to the Mayor and Corporation of Leeds:—

In answer to your invitation contained in an advertisement in various papers, we entertained the idea of competing for the above; but, before doing so (seeing that many of the competitions in which we have engaged have resulted in most unfair and biassed awards), we, for our own satisfaction, wrote to your town clerk, suggesting that as a protection to strangers against local interest, the plans should be marked with a motto; and in reply to which Mr. Curwood, on the 17th of April, 1873, wrote as follows:—

"I thought of the motto arrangement, but as a stranger will be called in to decide, there will be no prejudice."

Upon the faith of this assurance we decided to compete, and in order worthily to do so, we have spared neither trouble nor expense to produce a creditable set of plans.

We were, therefore, much surprised, in reply to our query as to the name of the strange professional gentleman whom the council had consulted, to receive a letter from the town clerk, dated the 6th of February, 1874, informing us that the committee had decided not to call in any professional gentleman to assist them in this competition, but to make the selection themselves, rather trusting to their own judgment.

Whilst entertaining the greatest respect for the members of the committee personally, yet seeing that a question like this can only be settled by a competent and impartial professional gentleman, we regret that in justice to ourselves, and other strange competitors, we must protest against any award being made, unless by the advice of some well-known and unprejudiced landscape-gardener, civil engineer, or architect, who would come under the term of the "stranger" referred to in your town clerk's letter of the 17th of April, 1873.

J. WALLACE PEGGS,
GEORGE WM. USILL,
G. WALLER WILLCOCKS.

CAUTION TO CONTRACTORS AND BUILDERS USING UNSAFE MACHINES.

A CASE of trade interest has occupied the attention of the Court of Exchequer and a special jury the whole of two days.

The action was brought by a stonemason, named Shell, against Messrs. Webster, the contractors, to recover compensation for serious personal injuries sustained in consequence of the alleged negligence of the defendants, or their servants; but, as will be seen, the cause of the action arose from an alleged defective trolly.

Messrs. Webster having contracted for the erection of a large hotel, at the low level of the Holborn Viaduct, Mr. Daniel Shell, was employed on the job as a skilled stonemason.

On the 5th of last June, the plaintiff, and his labourer, were engaged in preparing to lift a large block of stone, nearly weighing 3 tons, to be placed upon a pier to hold the girders, when the trolly on which the stone was placed suddenly tipped up. The effect was to pitch the mason between the rails beneath, with the stone partially upon him. He escaped with his life, was extricated from the stone, and at once taken to St. Bartholomew's Hospital, where he remained in a very critical state until August 26th, when he became an out-patient until the 4th of December. Up to the time of the accident, he was in the weekly receipts of two pounds and upwards wages.

The plaintiff attributed the misfortune to the employment of an unsuitable or defective trolly, and unfitted for the work. He stated that he had never known any but stone trolleys used for stonework of the heavy kind he was at work on; and the bed of this trolly being on the same level as the platform, close to which it was placed at the time of the accident, prevented him seeing the axle or wheels. The piers were being constructed of large stones prepared on the platform and siding close by. They were then put separately on the truck or trolly, to be subsequently dressed, lifted, and placed upon the piers that were to receive them on the low level.

The Hon. A. Thesiger, counsel for Messrs. Webster, said his clients deeply commiserated the plaintiff for his sufferings, and did not dispute the nature and extent of his injuries, but Messrs. Webster and their foreman considered that the trolly complained of was a proper and suitable one for the purpose, and that it had been in daily use since the plaintiff was in defendants' employment, early in last May; and that the plaintiff himself was a contributory to the accident by standing along with his labourer on such a part of the trolly as, by their additional sixteen-stone weight, the proper centre of gravity was changed, and caused the machine to tip over.

As usual in disputes of this kind, the evidence was conflicting, especially as to the trolly's fitness for heavy stonework.

The judge, Baron Amphlett, having summed up, the jury gave a verdict for the plaintiff, with 250*l.* damages and costs.

In connexion with the above, it was stated that the unfortunate man is a member of the Operative Stone Masons' Society, from which he has been allowed 10*s.* a week sick money for twenty-six weeks, and 5*s.* per week as long as his illness continues. If Mr. Shell's injuries prove to be of a permanent nature, the Society will award him the liberal grant of 150*l.* Had he been killed his friends would have received 50*l.*, besides 12*l.* for funeral and other grants. At the wife's death 10*l.* would have been granted for her funeral. Grants would have been made to the orphans, and, all honour to the members of the Operative Stone Masons' Society, St. Bartholomew's Hospital will be recouped for affording a "brother" relief.

BUILDERS' CONTRACTS.

SIR,—Will any of your numerous readers kindly favour us with their experience with respect to the legality of builders' contracts?

We, some time ago, tendered for a job of about 2,300*l.*, in conjunction with two other builders, and our tender, being the lowest, was accepted, and the contract signed by us, *but not by the employer*. The latter altered his mind, and has since carried out the works by employing his own workmen, and paying them weekly, under the supervision of his architect and a clerk of the works. As we had incurred considerable expense in obtaining quantities (they were not supplied), we are of opinion that we have a claim, not only for the expenses incurred, but also for our own loss of time and profit through the works not having been executed by us. We have taken two opinions on the matter, the one favourable and the other not, the lawyer in the latter case being of opinion that the contract is illegal. We think, however, that the *custom of the trade* would make it otherwise (the employer's signature being rarely affixed to the agreement); and should be glad if any of your numerous readers could supply us with a case in point.

BLANDFORD & JONES, Builders.

FOURTEEN LIBELS ON A SURVEYOR.

A SINGULAR action has been brought in the Court of Queen's Bench, by Mr. Gray, a surveyor, against Mr. Jones, a financial agent. It appeared that the General Post-office had rented premises in which Mr. Gray was interested, in Gresham House, for telegraphic purposes, and the Post-office wished to get rid of the tenancy before the legal expiry.

The defendant was promised a commission of 30*l.* if he could procure 3 0*l.* from the Post-office for the release, and he got offered that sum. Mr. Gray, however, negotiated himself direct with the Post-office, and got 350*l.* for the acquittance of agreement, and then refused to pay the 30*l.* commission to the defendant, alleging that the arrangement had been put an end to.

This repudiation riled the temper of the financial agent, and he sent fourteen post-office cards to Mr. Gray, telling him a smart bit of his mind in no measured language.

Mr. Gray now brought his action to recover damages for fourteen alleged libels.

The jury eventually found that some few of the cards were libels, and found for the plaintiff, one farthing damages.

STEEL BARS INSTEAD OF BELLS.

SIR,—I have been informed that, in some cases, steel rods struck by hammers have been lately substituted for church bells. If the plan is a practicable one, I have an opportunity of introducing it in two churches in Dorsetshire. I have made more than one attempt to procure the particulars of this invention, and the cost of fitting it. If any of your correspondents can furnish me with the requisite information, I shall be glad to receive it.

CHARLES TURNER.

*** We have received several similar letters lately.

OLD PARTY WALLS.

AT the Guildhall, Colonel Croll, the lessee of Nos. 27, 28, and 29, Coleman-street, and the occupiers of Nos. 1, 2, and 3, Mason's-avenue, were summoned before Alderman Ellis by the Commissioners of Sewers to show cause why a party-wall between the two properties should not be pulled down and rebuilt.

Mr. Straight appeared for the Commissioners of Sewers, Mr. Besley for Colonel Croll, and Mr. Weightman, solicitor, for the occupiers of Nos. 1, 2, and 3, Mason's-avenue.

The freehold of the whole of the property belonged to Christ's Hospital. Colonel Croll held a lease of 27, 28, and 29, Coleman-street, and other persons the leases of the other three houses. Colonel Croll pulled down his three houses to build a large warehouse. He gave the usual notices respecting the party-wall, but very little attention was paid to them. It was found that the party-wall, which was over 200 years old, leaned inwards at the top towards the houses in Mason's-avenue. Colonel Croll wanted to have the party-wall rebuilt, but as nobody would make himself responsible for any part of the expense, he underpinned the old wall, ran up an outside wall for himself, and abandoned the party-wall altogether. The consequence was, that when his wall was finished there was a space of 1 ft. between the two walls.

Mr. Woodthorpe, surveyor to the Commissioners of Sewers, stated that the party-wall was dangerous in the event of a fire, or the flooring giving way. The upper part of the wall was rotten on Colonel Croll's side, but there were no signs of decay on the inside of the walls. He considered that the party-wall was dangerous, and ought to be repaired, as the floorings and roofs were holding up the wall instead of the wall holding them up.

Mr. Thomas Renton, the surveyor to Christ's Hospital, said he did not agree with Mr. Woodthorpe that the wall was in a dangerous state.

Alderman Ellis made an order for the upper part of the wall, which was admitted on both sides to be rotten, to be taken down and rebuilt.

CASES UNDER THE METROPOLITAN BUILDING ACT.

LAPSE OF TIME.

AT the Greenwich police court the representatives of Mr. W. Fisher, deceased, late of the Gloucester Tavern, Greenwich, were summoned at the instance of Mr. Tabberer, the district surveyor, appointed under the Metropolitan Buildings Act, for having a building erected on such premises, the same not being enclosed with walls built of stone, brick, or other incombustible material.

The building in question consists of a long verandah, used for accommodating visitors in the summer time. It was discovered in the course of erection in April of last year, in the lifetime of the deceased.

Mr. Pook, who appeared for the defence, submitted that there was an omission from the Metropolitan Buildings Act of any provision making the representatives of a deceased person liable for the consequences of an act done by the deceased person in his lifetime.

Mr. Patterson said that the summons must necessarily be dismissed, as the law required information of the irregularity to be laid before a magistrate within six months of discovery.

The summons was then dismissed.

THE UTILISATION OF WASTE STEAM.

ON a recent evening, at Stafford House, Mr. Spence exhibited to a distinguished audience a plan by which he proposes to employ the heat of waste steam as a substitute for fuel. This method is founded upon a discovery made by the father of the inventor, and announced by him to the British Association at its meeting at Exeter in 1869. The discovery was that steam liberated at atmospheric pressure—that is, at a temperature of 212 deg.,—and passed into any saline solution having a boiling temperature higher than that of water, would raise this saline solution to its own boiling point. Thus, as Mr. Spence showed experimentally, if we take a solution of nitrate of soda, which boils at 250 deg., and if we blow into that solution steam at 212 deg., the temperature of the solution will be raised to 250 deg., the steam being condensed and yielding its heat. The explanation seems to be that the salt has a stronger affinity for the water in the steam, as water, than the heat has for its vapour. The water is therefore seized by the salt, and the latent heat is evolved as heat of temperature.

The solution having been to some extent diluted by the condensation of the exhaust steam, its capacity for heat will be reduced in a corresponding degree; and if steam at 212 deg. were again blown through it, it would not reach the same temperature as before. It is therefore passed into another boiler of ordinary construction, where it takes the place of water, and is concentrated by steam being generated from it. In this way its original capacity for receiving heat is restored.

Mr. Spence maintained that if, by taking advantage of his father's discovery, a mode of utilising the large amount of latent heat contained in the steam now thrown into the atmosphere could be brought into practical operation, so that this latent heat could be made to do actual work, the discovery, especially at the present price of fuel, would be one of enormous value, and he announced his intention of speedily trying the experiment on a manufacturing scale.

VARIORUM.

Long Ago has this month a variety of readable matter, among which are papers on the olden laws of England,—sanitary laws,—by the late Mr. R. Andrews; on old English modes of burial, by Mr. Llewellyn Jewett, F.S.A.; on our National Anthem, by Mr. T. L. Southgate; on Pepys and St. Olave's, by the Rev. W. J. Loftie, F.S.A.; and others.——*Nature*, for the week ending 12th February, has a leading paper on "A Minister for Science," and others on that interesting planet Mars, in which past and doubtful interpretations of its telescopic appearances are discussed, by Mr. T. W. Webb; on the polarisation of light, by Mr. W. Spottiswoode; and a new classification of birds.

Miscellanea.

Technical Education.—At a meeting of the Master, Wardens, and Court of the Painter-stainers' Company, held at the Guild, on Wednesday, the 4th of February, with a view to promote the important subject of Technical Education, they have determined to invite competition, and offer prizes for the year 1874, in the following subjects:—decorative painting in ornament, in oil or tempera, first prize, 5*l.*; second prize, 3*l.* Painting from natural foliage or flowers, first prize, 5*l.*; second prize, 3*l.* Free-hand drawing and design, first prize, 3*l.*; second prize, 2*l.*; in pencil, chalk, or shaded in water-colours. It has been the object of this Guild, from their first effort in the year 1852, to promote to the utmost extent in their power technical education; and they hope by thus giving an early intimation of rewards to induce competition among the operative and industrious classes in the above branches—open to young men under thirty years of age. Specimens in competition to be sent in by the middle of May.

The Ventilation of Ships.—At a meeting of the Royal Civil Service Institution, Whitehall-yard, a paper has been read by Staff-Surgeon J. P. Macdonald, R.N., assistant professor of naval hygiene at Netley Medical School, on the ventilation of ships, more especially of low free-board and hospital ships. Admiral Sir Spencer Robinson was in the chair. The lecturer dealt with this subject on the nomination of the Director-General of the Medical Department, and with the sanction of the Admiralty. It was a subject which had always been an important one to our navy, and it was more particularly so at the present time, owing to the rapid march of the science of naval architecture of late years in view of the requirements and exigencies of modern warfare. As far as his own suggestions were concerned, the lecturer said, the simple statement of the case was this, that under existing circumstances, while much valuable space was lost, instead of turning it to good account, ascending currents of impure air were constantly rolling into the cabins of the officers, and the sleeping-places of men to mix with air already contaminated with the products of respiration, combustion, &c., and for the escape of which no rational provision was made. It occurred to him, that, as iron box keels and kelsons had already been introduced to answer the purpose of parts requiring great strength as an essential condition, a hollow iron or box shelf-piece might be substituted for the ordinary one of wood. Thus, without making any noticeable alteration in the normal appearance of the ship's side, either within or without, the great desideratum of a continuous air-tube just below the beam ends, and holding communication with all the openings immediately below it, would be obtained. The ventilation or the removal of the heated air of each deck could be provided for through the intercostal channels of the next deck above. The practicability of the lecturer's proposal, and some of the advantages he claimed for it, appeared to be generally admitted.

Tidal Action as a Geological Cause.—Mr. T. Mellard Reade, C.E., F.G.S., has read an interesting paper before the Liverpool Geological Society, containing a series of novel investigations on the action of tides on the sea bottom. A study of the drift-beds of the north-west of England originally led him on the track of these discoveries. Mr. Reade entered elaborately into the phenomena of the tides in the Irish Sea, English Channel, and surrounding seas. Charts were exhibited showing the course of the stream tide in the Irish Sea, the lines of equal range calculated for a 30 ft. tide at Liverpool, and the set of the outgoing tides in the Irish Seas, Bristol Channel, and the English Channel at the same instants of time. The character of the sea bottom surrounding the British Isles was minutely described, and shown in the Irish Sea to be either mud, sand, shells, gravel, or stones, or mixtures of some or all of these materials in varying proportions, and the assortive power of the tidal currents was dwelt upon. It was also shown that there are pits or gullies excavated in the bottom, in both the English and Irish Channels, and that these depressions have generally their major axes conformable in direction with the set of the stream-tide; and that the contour lines of the bottom approximately follow the same direction. In conclusion, Mr. Reade expressed his conviction that the diurnal and semi-diurnal movement of the tides acting down to the profoundest depths of the ocean, accounts for the preponderance of life in it over that exhibited by the fauna of the Mediterranean.

London International Exhibition, 1874. The committee for architectural designs held its first meeting on the 13th inst. at the Royal Albert Hall. The following gentlemen were present:—Mr. James Fergusson, F.R.S., Mr. A. Waterhouse, Mr. T. Hayter Lewis, Mr. T. R. Smith. Lieutenant H. H. Cole, R.E., attended the meeting. The committee recommended that a special collection of designs for scholastic buildings be invited for this year's Exhibition, the collection to include designs for colleges, schools, museums, and libraries. It was further suggested that this be followed in future years by commercial, ecclesiastical, municipal, and domestic designs, in order that each year should have a special feature in the class of architecture.

The Royal Hibernian Academy.—The Lord Lieutenant and Lady Spencer have opened the Exhibition of the Royal Hibernian Academy at Dublin. There was a large attendance.

The Manufacture of Ice.—Tons of ice are being made by Messrs. Siebe & West, at their engineering manufactory, in Mason-street, Lambeth, and a large number of gentlemen (prominent amongst whom was Sir Robert Peel) have been witnessing the process of ice-making patented by the firm, and purchased by the International Ice-making Company (Limited). The principle upon which the ice-making machine is constructed is the production of cold by the evaporation of a volatile liquid, such as ether, *in vacuo*, by means of a refrigerator charged with the liquid ether, and in that vessel an intense degree of cold is produced by means of an air-pump, by the constant evaporation of the imprisoned ether, the vapour from which, being pumped into a condenser, becomes liquified, and returns through a pipe to the refrigerator, for another course of evaporation. The cold being thus obtained is utilised for the making of the ice. In this way from 1 ton to 10 tons of ice can be made in twenty-four hours, according to the size of the machine. The ice is transparent and beautiful to look at.

Improvement of Portland-place.—Messrs. W. & R. Powell write,—We have often thought that it would be a very great improvement to Portland-place if the roadway were lined with trees, like a Parisian boulevard, or with belts of shrubbery, like Westbourne-terrace, Hyde Park. Unquestionably Portland-place is a grand thoroughfare,—the broadest open street in London,—but it must be confessed that it is rather bald and dismal. Formerly its aspect of respectability was almost funereal, but of late years the decoration and modernising of the houses have made it look more cheerful; still a row of green trees on either side we think would add a great charm to the perspective. It would also make it a pleasant fashionable promenade and comfort to all adjacent Londoners cooped up within four brick walls so many months of the year. The expense of making this improvement would not, of course, be much, especially if done in a reasonable and economical spirit, and we presume it would rest with the parish, as curators of public ways, to carry it out; but the resident inhabitants and neighbours should commence the movement by memorialising the vestry.

Indian Antiquities.—Dr. J. W. Leitner, of Lahore, has delivered a lecture before the members of the Royal Asiatic Society, Albemarle-street. Sir Bartle Frere presided. The lecturer, in speaking of his works and discoveries in India as regards its antiquities of art and literature, disclaimed any intention of establishing theories. His researches had been confined principally to Northern India, and he had discovered 184 specimens of Bhuddist sculptures which he had brought to England. They showed that there had been a much closer connexion with the Greek school of art than was generally supposed. In fact, Greek art was distinctly to be seen in most of the sculptures. He had paid great attention to the literature of Cashmere, and had discovered many interesting and valuable manuscripts of obsolete languages. He had also, quite by accident, discovered that the shawl weavers of Cashmere had a distinct dialect of their own. The goldsmiths, likewise, use a peculiar dialect; while a "thieves' Latin" was in use, even under the very nose of the deputy-commissioner, without that functionary being aware of it.

Messrs. Lawrence & Sons.—Mrs. Jane Lawrence, whose death on Saturday, in her 80th year, has been announced, was the widow of Mr. William Lawrence, the founder of the well-known building firm of Wm. Lawrence & Sons. He was elected Alderman of Bread-street ward in 1848, served the office of Sheriff of London and Middlesex, 1849–1850, and died in 1855. Mrs. Lawrence had the gratification of seeing two of her sons, Aldermen William Lawrence and Sir James Clarke Lawrence, Lord Mayors of London and members of Parliament for the City of London and borough of Lambeth respectively. She survived, by only ten days, her daughter Emma, who occupied the position of Lady Mayoress to Sir James Clarke Lawrence in 1868–1869. She retained the full possession of her faculties to the last, and died peacefully without a struggle.

Drainage of Torquay.—Mr. William Pook, of Torquay, engineer, has been appointed by the St. Marychurch Local Board of Health to prepare plans for a new system of main drainage. There were four applicants for the office.

Royal Institution.—Dr. Doran's discourse last week, titled "The Opponents of Shakspeare," gave great pleasure to those who heard it. Commencing with Dryden, as the first opponent, and then speaking of his many followers, men who afterwards polluted the English stage, the speaker showed by delicate analysis how entirely they overlooked the real moral of the several plays with which they dared to meddle, instancing especially "Macbeth," "Romeo and Juliet," and the "Merchant of Venice." The criticisms of Voltaire were alluded to, and the comparative merits of the classical and natural school discussed; the speaker in his peroration dwelling admirably on the value and the rarity of the real poet—a rarity so extreme that the truly great poets of the world might be counted on the ten fingers with one or two to spare. The discourse, which was equally eloquent and wise, was listened to throughout with fixed attention by a critical and distinguished audience.

The Case of the Public Parks.—A large meeting of the inhabitants of Battersea was held to protest against the order which has recently been issued directing the withdrawal of the park-keepers from Battersea Park, and handing over its custody from the 1st of April next to the Metropolitan police. It was contended that the duties of park-keepers were well performed by the men at present employed, who were old soldiers with very small pensions, and that the police would be better engaged in looking after criminals and preventing crime. It was also contended that the cost to the rate-payers, if the change was carried out, would be more than doubled. At the conclusion of the proceedings, which were very enthusiastic, a committee was formed to make arrangements for a great demonstration, to be held in a few days, "to keep the police out."

A New Police Station in Islington.—The population of the northern portion of the parish of Islington having greatly increased of late years, Upper and Lower Holloway wards alone containing nearly 70,000 inhabitants, without having any police station within a considerable distance, a temporary station was opened about two years ago in Seven Sisters'-road, and placed under the charge of Inspector Stanford. But experience showed there was an urgent necessity for a much larger building, and a plot of ground has been obtained in Hornsey-road, near the Wesleyan chapel, for the site of a new police-station, which will be built according to the plans of Mr. J. H. Caiger, surveyor to the police receiver. The ground is now being cleared for the purpose of commencing the erection of the building.

The City Pavements Question.—On Wednesday, at a meeting of this commission, held at Guildhall, Mr. W. Sutton Gover, their chairman, presiding, Mr. H. E. Knight, pursuant to notice, brought forward a motion in relation to the question of asphalte, wooden, or granite pavement, which more than ever is engaging public attention in the City, as elsewhere. The motion was founded upon an elaborate report by Mr. Haywood, the engineer to the Commission, on the subject, the preparation of which, together with the preliminary inquiries in relation to the matter, is said to have cost the Corporation far towards 1,000*l*. After discussion, the motion of Mr. Knight was adopted, to the effect that, under proper conditions, asphalte, granite, and wood might continue to be laid as pavements in the city of London.

Untrapped Sewers and Blood Poisoning. At an inquest held at Oldham, on Tuesday, on the body of a child who had died of blood poisoning, the coroner (Mr. Molesworth) said that in that part of his district where the slop-stone pipes are not connected with the drains, and where there is a population of 9,400, there has not been a single case of the sudden death of a child for the last three years; whereas at Oldham and Rochdale, where the pipes are connected with the sewers, there has been on an average one death every fortnight, the children dying from blood poisoning caused by bad gases emitted through the slopstone pipes.

Mount Sinai.—Dr. Beke reports from the Gulf of Akaba that he has found the true Mount Sinai one day's journey north-east of Akaba. It is called by the Arabs Jebel el Nur, or Mountain of Light. Its height is 5,000 ft. On the summit Dr. Beke found the remains of sacrificed animals, and lower down some Sinaitic inscriptions, which he copied. (?)

Thorndon.—The new schools in connexion with this parish have been opened by the rector. The designs and general arrangement of the building were furnished by the rector, and they have been carried out by the contractor, Mr. George Grimwood, builder, Weybread. The edifice is of a plain Gothic character, and, next to the church, near which it stands, is a most conspicuous object in the parish. The entrance is through a wooden porch at the south-west corner. The principal room is 40 ft. by 18 ft., and, with a class-room, 18 ft. by 18 ft., will accommodate upwards of 100 children. The walls are of red bricks, and the windows and dressings and buttresses are of white bricks, roofed with red and grey ornamental tiles. The internal fittings and open-timbered roof, and the external woodwork of the porch and decorated gables, are of red pitch pine, stained and varnished.

Self-acting Water-valves in Fires.—The fire in Belgravia has brought under notice an invention of which some particulars were given in 1865. It is called Harrison's self-acting preserver valve, for the protection of life and property from fire; and consists, it may be remembered, of valves of fusible metal, which melt at the heat of boiling-water and liberate a water-supply to the protected buildings. It is intended that the valves and pipes be supplied to various parts of the building, wherever there may be any risk or chance of fire. The apparatus can also be arranged so as to give an alarm either on the spot or by telegraph to a distance.

Chopping through the Telegraph Wire between Australia and Europe.—An Adelaide telegram states that the commander of some vessel, having fouled the cable between Singapore and Penang with his anchor, deliberately severed the wire with an axe, in order to save, perhaps, half an hour's trouble. The Australian colonies were thus deprived of their ordinary channel of telegraphic communication with Europe for some days, so that an ignorant or an ill-natured sea captain might not suffer a little temporary inconvenience. In what savage wilds could worse be expected? The name of this hero deserves commemoration!

The London General Omnibus Company's Dividend for the last half-year is at the rate of 8 per cent. per annum, or the same as for the previous six months, but it compares with 10 per cent. in the corresponding period of last year.

Plain Rules for the Management of Infants.—A flyleaf, prepared by Dr. E. Lankester, on this subject, has been published by Hardwicke, of Piccadilly. It contains some simple and useful rules, and is well adapted for distribution among the poorer classes.

The Bury Accident.—The inquest has been held on the bodies of nine persons who met with their deaths through the floor giving way during an election meeting at Bury, Lancashire, on the 2nd inst. Mr. Howe, builder, of Bolton, stated that the building was a very weakly constructed one, and although the timber was not rotten, it was going in that direction. After other witnesses had been examined, the jury returned a verdict of accidental death.

Drainage of Richmond, Surrey.—In consequence of a report from Mr. James Abernethy, C.E., the Vestry of Richmond have resolved, "That it is not expedient to proceed further with Messes. Russ & Minns's scheme," of which they had previously approved.

The Institution of Civil Engineers.—The annual dinner has been fixed for Saturday, the 21st of March, at Willis's Rooms, St. James's.

Royal Literary Fund.—At the approaching anniversary dinner of this corporation, to be held in May next, Lord Coleridge will preside.

TENDERS

For completing new schools and north aisle of the church of St. Mary the Virgin, Crown-street, Soho. Mr. R. Herbert Carpenter, architect. Quantities supplied by Mr. W. H. Barber:—

Cowland	£3,657 0 0
Nightingale	3,093 0 0
Cocke & Green	3,076 0 0
Downs & Co.	3,073 0 0
Ennor	3,011 0 0
Sheppard	2,998 0 0

For the erection of additional servants' offices to Elmstone Court, near Wingham, Kent, for Mr. W. J. G. Barrett. Mr. Richard Martin, architect:—

Jarrett	£614 0 0
Smith & Martin	590 11 3

For additions to Brondesbury Park-villa, Willesden, for Mr. F. Machin. Messrs. Satchell & Edwards, architects:—

Sanders	£1,345 0 0
Hockly	1,291 0 0
Chessum	1,211 0 0

For alterations and additions to the Britannia public-house, Limehouse. Mr. Wm. Scott, architect:—

Sheffield (accepted)	£1,450 0 0

For Birmingham Municipal Buildings. Mr. Yeoville Thomason, architect:—

Barnsley & Sons (accepted)	£83,220 0 0

For alterations at the Barbican, Barbican, E.C. Messrs. Nunn & Green, architects:—

Cole	£1,116 0 0
Wagner	1,030 0 0
Battley (accepted)	970 0 0

For alterations at the Marlboro' Head Tavern, Bishopsgate-street Within. Messrs. Nunn & Green, architects:—

Wagner	£420 0 0
Taylor & Gurney	408 0 0
Cole	330 0 0
Hanley (accepted)	316 0 0

For alterations at 16, James-street, Buckingham-gate. Mr. J. T. Christopher, architect:—

Belham	£595 0 0
Wilks, Bros.	557 0 0
Reading	492 0 0
Wagner (accepted)	490 0 0

For work to be done at Nos. 10A, 11, 12, 13, 14, 15, and 29, South villas, Camden-square:—

Carter	£2,360 0 0
W. & A. Smith	2,094 18 0
Graham	1,900 0 0
Warne	1,890 0 0
Lovel	1,630 0 0
Allen	1,627 0 0

For offices and dwelling-house at Dyer's-court, Aldermanbury, for Messrs. Bradbury, Greatorex, & Co. Mr. W. G. Bartleet, architect:—

Colls	£4,936 0 0
Browne & Robinson	4,893 0 0
Ashby & Son	4,755 0 0
Ashby & Horner	4,640 0 0
Pritchard	4,595 0 0
Wood	4,569 0 0
Conder	4,598 0 0
Brass	4,496 0 0
Downs & Co. (accepted)	4,390 0 0

TO CORRESPONDENTS.

A. S. H.—G. W. U.—Dr. L.—A. H.—J. C.—W. C. A.—C. R. S.—Messrs. A. & Co.—J. C.—E. W. P.—S. & E.—E. W.—E. C. R.—W. G. S.—R. Y.—C. E. & Co.—H. R. W.—G. E. M.—N. B. B. (declined).—H. T. (next week).

We are compelled to decline pointing out books and giving addresses.

All statements of facts, lists of tenders, &c. must be accompanied by the name and address of the sender, not necessarily for publication.

NOTE.—The responsibility of signed articles, and papers read at public meetings, rests, of course, with the authors.

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Advertisements cannot be received for the current week's issue later than **THREE o'clock p.m.** *on THURSDAY.*

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